



BUZZARDS BAY WATERSHED

2000 WATER QUALITY ASSESSMENT REPORT



COMMONWEALTH OF MASSACHUSETTS
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BUZZARDS BAY WATERSHED
2000 WATER QUALITY ASSESSMENT REPORT

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Department of Environmental Protection
Division of Watershed Management

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- Environmental Protection Agency (EPA)
- United States Geological Survey (USGS)
 - Water Resources Division
- United States Army Corps of Engineers (ACOE)
- United States Fish and Wildlife Service
- National Oceanic and Atmospheric Administration (NOAA)

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- Massachusetts Department of Environmental Protection (MA DEP):
 - Bureau of Strategic Policy and Technology, Wall Experiment Station (WES)
 - Bureau of Resource Protection (BRP)
 - Bureau of Waste Prevention
 - Bureau of Waste Site Cleanup
 - Estuaries Project
- Massachusetts Department of Public Health (MDPH)
- Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE)
NOTE: As of July 2003 the agency name has changed to the Massachusetts Department of Fish and Game.
 - Division of Fisheries and Wildlife (MassWildlife)
 - Riverways Program
 - Division of Marine Fisheries (DMF)
 - Public Access Board
- Massachusetts Department of Environmental Management (MA DEM)
NOTE: As of July 2003, the agency name has changed to the Massachusetts Department of Conservation and Recreation, Division of State Parks and Recreation.
- Massachusetts Office of Coastal Zone Management (CZM)

Regional

- | | |
|--|---|
| • Coalition for Buzzards Bay (CBB) | • Mass Water Watch Acushnet River Stream Team |
| • Westport River Watershed Alliance (WRWA) | • Applied Science Associates |
| • Weweantic River Stream Team | • Camp Dresser & McKee (CDM) |
| • Six Ponds Association | • Environmental Science Services, Inc |
| • The Nature Conservancy | • ENSR International |

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LIST OF ACRONYMS

| | |
|--------|---|
| 7Q10 | Seven day, ten year low flow |
| AAW | Adopt-A-Watershed Project |
| ACEC | Area of Critical Environmental Concern |
| ACOE | US Army Corps of Engineers |
| AFCEE | Air Force Center for Environmental Excellence |
| ASA | Applied Science Associates |
| BBP | Buzzards Bay Project, National Estuary Program |
| BMP | Best Management Practice |
| BDL | Below Detection Limit |
| BOD | Biochemical Oxygen Demand |
| BPJ | Best professional judgment |
| BRP | Bureau of Resource Protection |
| CAFO | Concentrated Animal Feeding Operations, a type of NPDES permit |
| CBB | Coalition for Buzzards Bay |
| CCCG | Cape Cod Cranberry Growers |
| CCMP | Comprehensive Conservation and Management Plan |
| CDE | Cornell Dubilier Electronics, Inc. |
| CDM | Camp Dresser & McKee |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CMR | Code of Massachusetts Regulations |
| C-NOEC | Chronic no observed effect concentration |
| CSO | Combined Sewer Overflow |
| CWA | Clean Water Act |
| CWF | Cold Water Fishery |
| CZM | Office of Coastal Zone Management |
| DDT | Dichlordiphenyltrichloroethane |
| DFWELE | Department of Fisheries, Wildlife, and Environmental Law Enforcement |
| DMF | Division of Marine Fisheries |
| DO | Dissolved oxygen |
| DWM | Division of Watershed Management |
| DWP | Drinking Water Program |
| EMPACT | Environmental Monitoring for Public Access and Community Tracking |
| EMAP | Environmental Monitoring and Assessment Program |
| ENF | Environmental Notification Form |
| EOEA | Executive Office of Environmental Affairs |
| EPA | United States Environmental Protection Agency |
| EPT | Ephemeroptera, Plecoptera, Trichoptera |

LIST OF ACRONYMS (CONTINUED)

| | |
|--------------------|--|
| ESS | Environmental Science Services, Inc. |
| FERC | Federal Energy Regulatory Commission |
| GIS | Geographic information system |
| LC ₅₀ | Lethal concentration to 50% of the test organisms |
| MS4 | Medium and large municipal separate storm sewer systems |
| MA DEM | Massachusetts Department of Environmental Management |
| MA DEP | Massachusetts Department of Environmental Protection |
| MassGIS | Massachusetts Geographic Information System |
| MassWildlife | Division of Fisheries and Wildlife |
| MCWW | Massachusetts Community Water Watch |
| MDI | Method Detection Limit |
| MDPH | Massachusetts Department of Public Health |
| MPN | Most probable number |
| MMR | Massachusetts Military Reservation |
| NAS/NAE | National Academy of Sciences/National Academy of Engineering |
| NBH-LTR | New Bedford Harbor Long Term Monitoring Program |
| NCCW | Non-Contact Cooling Water |
| NDA | No Discharge Area |
| NEP | National Estuary Program |
| NH ₃ -N | Ammonia-nitrogen |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| NPS | Non-point source pollution |
| ORW | Outstanding Resource Waters |
| PAB | Public Access Board |
| PAH | Polyaromatic Hydrocarbon |
| PALIS | Pond and Lake Information System |
| PCB | Polychlorinated biphenol |
| PCE | perchloroethene |
| POTW | Publicly Owned Treatment Works |
| PWS | Public water supply |
| QAPP | Quality assurance project plan |
| QA/QC | Quality assurance/ quality control |
| RBP | Rapid bioassessment protocol |
| ROD | Record of Decision |
| SARIS | Stream and River Inventory System |
| SDWA | Safe Drinking Water Act |
| SMASST | School of Marine Science and Technology at UMass Dartmouth |
| SOP | Standard operating procedure |
| STP | Sewage Treatment Plant |
| SWAP | Source Water Assessment Program |
| SWQS | Surface Water Quality Standards |
| TCE | Trichloroethene |
| TIE/TRE | Toxicity identification and toxic reduction evaluation |
| TMDL | Total maximum daily loads |
| TOC | Total organic carbon |
| TOXTD | MA DEP DWM Toxicity Testing Database |
| TRC | Total residual chlorine |
| TSS | Total Suspended Solids |
| UMass | University of Massachusetts |
| USGS | United States Geological Survey |
| UV | Ultraviolet |
| VOC | Volatile Organic Compound |
| WBID | Waterbody Identification Code |
| WBS | Waterbody System Database |
| WES | Wall Experiment Station |
| WMA | Water Management Act |
| WPCF | Water Pollution Control Facility |
| WRWA | Westport River Watershed Alliance |
| WWF | Warm Water Fishery |
| WWTP | Waste water treatment plant |

LIST OF UNITS

| | |
|-----------------|--------------------------------|
| cfs | Cubic feet per second |
| cfu | Colony forming unit |
| Cm | Centimeter |
| ft ³ | Cubic feet |
| GPD | Gallons per day |
| g/L | Gram/liter |
| KW | Kilowatt |
| m | meter |
| m ³ | Cubic meter |
| mg/kg | Milligram/kilogram |
| mg/L | Milligram/liter |
| MG | Million gallons |
| MGD | Million gallons per day |
| MGY | Million gallons per year |
| mL/L | Milliliter per liter |
| μg/g | Microgram per gram |
| μg/kg | Microgram per kilogram |
| μg/L | Microgram per liter |
| μM | Micromoles |
| μS/cm | Microsiemens per centimeter |
| ng | Nanogram |
| NTU | Nephelometric turbidity units |
| ppb | Parts per billion |
| ppm | Parts per million |
| ppt | Parts per thousand |
| SU | Standard units |
| TEQ/kg | Toxic equivalents per kilogram |

EXECUTIVE SUMMARY

BUZZARDS BAY WATERSHED

WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which surface waters in the Commonwealth shall be protected. The Massachusetts Department of Environmental Protection (MA DEP) is responsible for the assessment of current water quality conditions, which is a key step in the successful implementation of the watershed approach. This critical phase provides an assessment of the support status of the designated uses (support, impaired, or not assessed), as well as basic information needed to focus resource protection and remediation activities later in the watershed management planning process.

This assessment report presents a summary of current water quality data/information used to assess the status of these designated uses as defined in the Massachusetts Surface Water Quality Standards: *Aquatic Life, Fish Consumption, Drinking Water, Shellfish Harvesting* (where applicable), *Primary and Secondary Contact Recreation* and *Aesthetics*. Each use, within a given segment, is individually assessed as **support** or **impaired**. When too little current data/information exists or no reliable data are available the use is **not assessed**. However, if there is some indication of water quality impairment, which is not "naturally occurring", the use is identified with an "Alert Status". It is important to note that not all waters are described in this assessment report. Many small and/or unnamed rivers and ponds are currently **unassessed**; the status of their designated uses has never been reported to EPA in the Commonwealth's 305(b) Report nor is information on these waters maintained in the Water Body System (WBS) database.

The Buzzards Bay Watershed, a coastal river drainage area, has land areas on both the mainland and on Cape Cod. It contains freshwater streams that flow into Buzzards Bay. There are a total of 16 river, stream, brook, or creek segments (the term "rivers" will hereafter be used to include all) and 47 estuary/coastal embayment segments assessed in this report in the Buzzards Bay Watershed.

The river segments include the freshwater portions of the Agawam, Wankinco, Weweantic, Sippican, Mattapoisett, Acushnet and East Branch Westport rivers and Snell Creek. Additionally, Buttonwood Brook, Paskamanset River, Copciut River, Shingle Island River, an unnamed tributary to the Shingle Island River, and Bread and Cheese Brook are also assessed in this report. These assessments represent 85% of the 71 named streams and approximately 40% (66.55 miles) of the estimated total of 167 "named" river miles in the basin. The one unnamed tributary to the Shingle Island River adds another 1.01 miles to the total river length assessed in this report. The remaining rivers are small and/or unnamed and currently unassessed.

Coastal embayments/estuaries assessed in this report total 40.60 mi² and include the saltwater/estuarine portions of the Agawam, Wankinco, Weweantic, Sippican, Mattapoisett, Acushnet and East Branch Westport rivers and Snell Creek; Buttermilk, Onset, and Apponagansett bays; Hammett, Aucoot, Hiller, and Clarks coves; Sippican, Mattapoisett, New Bedford Inner, Outer New Bedford, Phinneys, Pocasset, Red Brook, Squeteague, Megansett, Wild, West Falmouth, and Quissett harbors; Eel Pond in Mattapoisett; Eel Pond in Bourne; the Cape Cod Canal; Harbor Head; and the open coastal water outside of New Bedford Harbor/Apponagansett Bay.

This report also includes information on 69 of the 173 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) in the Buzzards Bay Watershed. The 69 lakes assessed in this report represent 4,488 acres of the 7,106 total lake acres (or 63% of the lake acreage) in the watershed.

Bouchard Barge 120, a 25 -year-old single hulled barge, owned by Bouchard Transportation Co. Inc., carrying 865,200 gallons of Number 6 ("Bunker C") fuel oil started leaking oil into Buzzards Bay on Sunday, 27 April 2003. It was estimated that up to 98,000 gallons of oil spilled into the area. Immediate impacts to shellfish resources (all beds closed), flora/fauna/aquatic life (number of dead birds/fish), and bathing beaches (closures) are not assessed in this report. Long-term affects will be assessed in the next Buzzards Bay Watershed Water Quality Assessment Report. Updated information is available on the Buzzards Bay Project website (<http://www.buzzardsbay.org/oilspill-4-28-03.htm#updates>).

AQUATIC LIFE USE

The *Aquatic Life Use* is supported when suitable habitat and water quality is available for sustaining a native, naturally diverse, community of aquatic flora and fauna. Impairment of the *Aquatic Life Use* may result from anthropogenic stressors that include point and/or non-point source(s) of pollution and hydrologic modification. Due to the lack of current quality-assured chemical and biological data, none of the rivers in the Buzzards Bay Watershed have been assessed for the *Aquatic Life Use* (Figure 1). However, issues identified in this report that could potentially impact the *Aquatic Life Use* include flow manipulation and its effects on fish passage in the Agawam, Wankinco, Weweantic, and Sippican rivers and water withdrawals from the subwatersheds of the Mattapoissett, Paskamanset, Copicut, Shingle Island rivers and the unnamed tributary. Additionally, the *Aquatic Life Use* for the Acushnet River is identified with an "Alert Status" due to the potential negative effects of elevated nutrients and oxygen depletion as evidenced in the Coalition for Buzzards Bay's poor health index score.

RIVERS
67.56 miles NOT ASSESSED

Only two of the estuaries in the Buzzards Bay Watershed, Aucoot Cove and Mattapoissett Harbor, are assessed as support for the *Aquatic Life Use* (Figure 1). The Agawam River (MA95-29) has been assessed as impaired due to elevated nutrients (unionized ammonia) and whole effluent toxicity. The Acushnet River and Inner New Bedford Harbor have been assessed as impaired for the *Aquatic Life Use* due to PCB contamination

ESTUARIES
1.60 square miles (4%) SUPPORT
16.86 square miles (42%) IMPAIRED
22.14 square miles (54%) NOT ASSESSED

(New Bedford Harbor Superfund site). Additionally, thirteen other estuaries/coastal embayments (Buttermilk Bay, Onset Bay, Slocums River, East Branch Westport River, West Branch Westport River, Westport River, Pocasset Harbor, West Falmouth Harbor, Wareham River, Weweantic River, Beaverdam Creek, Outer New Bedford Harbor, and Hammet Cove), totaling 15.14 square miles, have been assessed as impaired for the *Aquatic Life Use* due to the decline/loss of eelgrass bed habitat, which may be associated with elevated nutrients (total nitrogen). The remaining 22.14 square miles are currently not assessed. The Massachusetts Estuaries Project will evaluate the nitrogen sensitivity of 89 coastal embayments in southeastern Massachusetts through comprehensive water quality testing, develop a standard guidance for assessing nutrient impairment, develop Total Maximum Daily Loads (TMDLs) for impaired embayments, and develop management recommendations for communities to consider how implementation of nitrogen management scenarios within watersheds will influence water quality in embayments.

A relatively small number of lakes in the Buzzards Bay Watershed have recently been surveyed for variables used to assess the status of the *Aquatic Life Use* (e.g., dissolved oxygen, pH, nutrients, macrophytes, and plankton/chlorophyll *a*). Baseline lake surveys were conducted on eight lakes (TMDL sampling) in the summer of 2000 (Appendix A, Tables A2 and A3). Synoptic surveys conducted by DWM at 64 lakes in 1995 provided

LAKES
109 acres (3%) SUPPORT
1,489 acres (33%) IMPAIRED
2,890 acres (64%) NOT ASSESSED

less extensive and older information on more lakes (Appendix A, Table A1). Only two lakes in the Buzzards Bay Watershed, New Long Pond, Plymouth and Turner Pond in New Bedford/Dartmouth, are assessed as supporting the *Aquatic Life Use*. The majority (33%) of the lake acreage assessed is impaired for the *Aquatic Life Use* (Figure 4). The *Aquatic Life Use* is assessed as impaired in 13 lake segments primarily due to the presence of non-native aquatic plants, but other factors may include phosphates, organic enrichment/ low dissolved oxygen, and/or algal blooms. All 13 lakes - Crane Brook, Federal, Fresh Meadow, Tremont, Mill, Parker Mills, Sampson Ponds, New Bedford Reservoir, the two basins of White Island Pond and the three basins of Noquochoke Pond - are infested with non-native aquatic vegetation; *Myriophyllum heterophyllum* (variable milfoil) and/or *Cabomba caroliniana* (fanwort). These two non-native aquatic plant species reproduce vegetatively and are particularly invasive. Therefore, they may spread readily downstream on currents or by mechanical transport. Fifty-four lakes, representing 64% of the lake acreage in the Buzzards Bay Watershed, are currently not assessed for the *Aquatic Life Use*.

FISH CONSUMPTION USE

The *Fish Consumption Use* is supported when there are no pollutants present that result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of the *Fish Consumption Use* is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment (MDPH 2001a). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption; hence the *Fish Consumption Use* is assessed as non-support in such waters. In July 2001, MDPH issued new (updated from 1994) consumer advisories on fish consumption and mercury contamination (MDPH 2001b). Because of these statewide advisories, no waters can be assessed as support for the *Fish Consumption Use*; these waters default to "not assessed". The statewide advisories read as follows:

The MDPH "is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)." Additionally, MDPH "is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)." MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

MDPH issued site-specific advisories for five lakes in the Buzzards Bay Watershed because of elevated

mercury concentrations in fishes. They are Cornell Pond in Dartmouth, Long Pond and Snipatuit Pond in Rochester, Turner Pond in Dartmouth/New Bedford and the three basins of Noquochoke Lake in Dartmouth (Figure 5). In addition, there are elevated PCB concentrations in fish tissue from Cornell Pond and the three basins of Noquochoke Lake (MDPH 2002c). The *Fish Consumption Use* is also assessed as impaired due to mercury and PCB contamination for a total of 1.34 miles of

the Copicut River (Figure 2). Sources of mercury in this area are currently unknown, although atmospheric deposition is suspected. Sources of PCBs in Cornell Pond, the three basins of Noquochoke Lake and the Copicut River are linked to the Resolve Superfund site. No other lakes or rivers were assessed for the *Fish Consumption Use* in the Buzzards Bay Watershed. Additionally, the estuarine segments of New Bedford Inner Harbor and Outer New Bedford Harbor, Clarks Cove, Apponagansett Bay and Open Coastal Water outside of New Bedford Harbor have fish consumption advisories due to PCB contamination associated with the New Bedford Harbor Superfund site and, therefore, are impaired for this use.

| |
|------------------------------------|
| RIVERS |
| 1.34 miles (2%) IMPAIRED |
| 66.22 (98%) miles NOT ASSESSED |
| ESTUARIES |
| 17.94 sq. miles (44%) IMPAIRED |
| 22.66 sq. miles (56%) NOT ASSESSED |
| LAKES |
| 925 acres (21%) IMPAIRED |
| 3,563 acres (79%) NOT ASSESSED |

DRINKING WATER USE

The term *Drinking Water Use* has been used to indicate sources of public drinking water. While this use is not assessed in this report, the state provides general guidance on drinking water source protection of both surface water and groundwater sources (available at <http://www.state.ma.us/dep/brp/dws/dwshome.htm>). These waters are subject to stringent regulation in accordance with the Massachusetts Drinking Water Regulations. MA DEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act. DWP has also initiated work on its Source Water Assessment Program (SWAP), which requires that the Commonwealth delineate protection areas for all public ground and surface water sources, inventory land uses in these

areas that may present potential threats to drinking water quality, determine the susceptibility of water supplies to contamination from these sources, and publicize the results.

Public water suppliers monitor their finished water (tap water) for major categories of both naturally occurring and man-made contaminants such as: microbiological, inorganic, organic, pesticides, herbicides and radioactive contaminants. Specific information on community drinking water sources including SWAP activities and drinking water quality information are updated and distributed annually by the public water system to its customers in a "Consumer Confidence Report". These reports are available from the public water system, the local boards of health, MDPH, and MA DEP.

SHELLFISH HARVESTING USE

The *Shellfish Harvesting Use* is supported when shellfish harvested from approved Open Shellfish Areas (Class SA) are suitable for consumption without depuration and shellfish harvested from approved Restricted Shellfish Areas (Class SB) are suitable for consumption with depuration. The Division of Marine Fisheries (DMF) classifies shellfishing areas in the Buzzards Bay Watershed. The *Shellfish Harvesting Use* for this report was assessed using the DMF shellfishing closure list dated July 2000. Designated shellfish growing areas (as of July 2000) may be viewed using the MassGIS datalayer available from MassGIS at <http://www.state.ma.us/mgis/dsga.htm>.

On Monday April 28, 2003, in response to the Bouchard 120 oil spill, the Massachusetts Division of Marine Fisheries closed the lower two thirds of Buzzards Bay, southward to the Rhode Island border. The entire bay was closed April 30. The initial closures were precautionary and the Massachusetts Division of Fisheries reopened about 90,000 acres, or half the Bay, on May 22 after tests showed shellfish were safe in these areas. More heavily oiled areas remain closed. These closures are not reflective in the assessments of the *Shellfish Harvesting Use*. Additional information is available on the Buzzards Bay Project's website: <http://www.buzzardsbay.org/oilspill-4-28-03.htm>.

The status (as of July 2000) of the 261,901.301 acres of shellfishing beds in the entire Buzzards Bay Watershed (including areas that extend into open-water and areas not specifically included in this assessment report) is as follows:

| DMF Classification Type | MA DEP Use Support Status | DMF Area (Acres) | % of total DMF acreage |
|-------------------------|---------------------------|------------------|------------------------|
| Approved | Support | 232559.5 | 89% |
| Conditionally Approved | SB Waters- Support | 13187.88 | 5% |
| | SA Waters-Impaired | | |
| Restricted | SB Waters- Support | 6200.129 | 2% |
| | SA Waters-Impaired | | |
| Prohibited | Impaired | 9722.802 | 4% |
| Management Closure | Not assessed | 230.99 | 0.09% |

Individual DMF management area classifications are provided in Appendix E of this report. It should be noted that DMF's areas are defined in acres of shellfish habitat. Most of the acreage periodically closed to shellfishing is located in heavily used areas close to shore. Whereas, most of the approved acreage is in the deeper waters that are more difficult to harvest (Janik 2003).

PRIMARY & SECONDARY CONTACT RECREATIONAL AND AESTHETIC USES

The *Primary Contact Recreational Use* is supported when conditions are suitable (fecal coliform bacteria densities, pH, temperature, turbidity and aesthetics meet the Massachusetts Surface Water Quality Standards) for any recreational or other water related activity during which there is prolonged and intimate contact with the water and there exists a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing, water skiing, and windsurfing. The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreational or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating, and limited contact incident to shoreline activities. For lakes, macrophyte cover and/or transparency (Secchi disk depth) data are assessed to evaluate the status of the recreational uses. The

Aesthetics Use is supported when surface waters are free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

| Rivers | | |
|---|--|--|
| PRIMARY 9.95 miles (15%) IMPAIRED 57.61 miles (85%) NOT ASSESSED | SECONDARY 8.96 miles (13%) SUPPORT 0.99 miles (1%) IMPAIRED 57.61 miles (86%) NOT ASSESSED | AESTHETICS 11.46 miles (17%) SUPPORT 56.10 miles (83%) NOT ASSESSED |

| Estuaries | | |
|---|---|---|
| PRIMARY 21.61 mi ² (53%) SUPPORT 1.79 mi ² (4%) IMPAIRED 17.20 mi ² (42%) NOT ASSESSED | SECONDARY 21.61 mi ² (53%) SUPPORT 1.79 mi ² (4%) IMPAIRED 17.20 mi ² (42%) NOT ASSESSED | AESTHETICS 1.56 mi ² (4%) IMPAIRED 39.04 mi ² (96%) NOT ASSESSED |

The East Branch Westport River (MA95-40), Bread and Cheese Brook, and Snell Creek (MA95-44 and MA95-45) are all assessed as impaired for the *Primary Contact Recreational Use* as the result of elevated fecal coliform bacteria levels. Suspected sources of contamination include municipal separate storm sewer systems, highway/road runoff, on-site septic systems, poor manure management and grazing in the riparian zone. All other rivers in the Buzzards Bay Watershed are currently not assessed for the *Primary Contact Recreational Use* due to the lack of current quality assured bacteria data. However, 2.53 miles of the East Branch Westport River (MA95-40), Bread and Cheese Brook, and one segment of Snell Creek (MA95-44) are assessed as support for the *Secondary Contact Recreational Use*. Snell Creek (MA95-45) and 0.32 miles of the East Branch Westport River (MA95-40), downstream from the Gifford Road storm drain, are assessed as impaired for the *Secondary Contact Recreational Use* due to elevated bacteria counts (Figure 3).

The *Primary* and *Secondary Contact Recreational Uses* are assessed as support the entire Westport River, Squeteague Harbor, Megansett Harbor and Sippican Harbor segments.

A portion of the following segments are assessed as supporting the recreational uses: Buttermilk Bay, Onset Bay, the Wareham River, Weweantic River, Hammet Cove, Aucoot Cove, Hiller Cove, Mattapoisett Harbor, Nasketucket Bay, Apponagansett Bay, open water near New Bedford Harbor/Apponagansett Bay, Slocums River, East Branch Westport River, West Branch Westport River, Cape Cod Canal, Phinneys Harbor, Pocasset Harbor, Red Brook Harbor, West Falmouth Harbor, and Quissett Harbor. With the exception of the East Branch Westport River (see below) the remaining acreage of these segments is currently not assessed.

Snell Creek (MA95-59), the Acushnet River (MA95-33) and New Bedford Inner Harbor are impaired for the *Primary and Secondary Contact Recreational Uses*. Additionally, a portion of the East Branch Westport River (MA95-41) is also impaired for both of these uses. Source of impairment for Snell Creek and the East Branch Westport River include operations related to dairy farming (animal feeding operation, grazing in the riparian zone, dairy outside milk parlor area). Suspected sources of impairment for these segments include municipal separate storm sewer systems, on-site septic systems, highway/road runoff. Sources contributing to the impairment of New Bedford Inner Harbor include CSOs and the urbanized high density areas; waterfowl are also suspected. The Massachusetts Estuaries Project, while primarily evaluating the nitrogen sensitivity of 89 coastal embayments in southeastern Massachusetts, will develop bacteria Total Maximum Daily Loads (TMDLs) for a limited number of impaired embayments.

The *Primary* and *Secondary Contact Recreational Uses* have not been assessed at all for 20 segments (Figure 3).

Only the Weweantic River is assessed as support for the *Aesthetics Use*. The *Aesthetics Use* is assessed as impaired for the Acushnet River and New Bedford Inner Harbor as a result of oil & grease, odor, color, and trash and debris resulting from urban runoff/high density areas and CSO discharges (Figure 3). The remaining segments (both fresh and estuarine) are currently not assessed for the *Aesthetics Use*.

Ten lakes in the Buzzards Bay Watershed (Figure 6) are assessed as supporting both the *Primary* and *Secondary Contact Recreational Uses*. These lakes – Barrett, Charge, College, Curlew, Fearing, Glen Charlie, Queen Sewell, Sampson, Snipatuit, and Vaughn ponds – represent 18.9% (1338 acres) of the total lake acreage (7,106 acres) in the Buzzards Bay Watershed. Five lakes in the Buzzards Bay Watershed are assessed as impaired for both the *Primary* and *Secondary Contact Recreational Uses* and the *Aesthetics Use*. Crane Brook Bog Pond is impaired due to excess algal growth; Federal Pond is impaired due to non-native plants; New Bedford Reservoir is impaired due to non-native plants and phosphate; Parker Mills Pond is impaired due to non-native plants and phosphate; and the east basin of White Island Pond is impaired due to excess algal growth, Secchi disk transparency, and phosphate. Although sources are currently unknown, nutrient enrichment from storm water runoff; failing, substandard, or inappropriately sited sewage disposal systems; or drainage from agricultural lands is likely to contribute to increased macrophyte productivity, resulting in impairments to this use. Additionally, one basin of Noquochoke Lake (MA95170) is assessed as impaired for the *Primary Contact Recreation Use* due to elevated *Enterococci* bacteria concentrations. The majority of the lake acreage in the Buzzards Bay Watershed is not assessed for the *Recreational* and *Aesthetics uses* (roughly 55% and 83%, respectively).

| Lakes | | |
|---|--|--|
| PRIMARY 1338 acres (30%) SUPPORT 759 acres (17%) IMPAIRED 2,391 acres (53%) NOT ASSESSED | SECONDARY 1,338 acres (30%) SUPPORT 649 acres (14%) IMPAIRED 2,501 acres (56%) NOT ASSESSED | AESTHETICS 109 acres (2%) SUPPORT 649 acres (15%) IMPAIRED 3,730 acres (83%) NOT ASSESSED |

RECOMMENDATIONS

In addition to specific issues for the individual segments, the evaluation of current water quality conditions in the Buzzards Bay Watershed has revealed the need for the following actions.

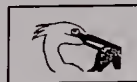
- Implement the recommendations developed by the Massachusetts Estuaries Project to minimize nitrogen enrichment and bacterial contamination to the coastal waters of Buzzards Bay.
- Determine the cause of low flows in the Mattapoissett and Paskamansett rivers and work to restore substantial flow for aquatic life.
- Work with interested stakeholders, including the Coalition for Buzzards Bay, Westport River Watershed Alliance, and Falmouth Pond Watchers, to collect quality-assured biological, physical, chemical, and bacteriological data to fully assess the designated uses of segments in the Buzzards Bay Watershed. Follow the strategy presented in the United States Geological Survey Statewide Water-Quality Network Report for examples of the monitoring necessary to completely assess all uses (DeSimone *et al* 2001).
- The flow manipulations associated with cranberry bog operations should be examined to determine their impacts to anadromous fish migrations throughout the watershed. Additionally, cranberry bog and water supply dam operators in the watershed should be encouraged to develop and implement flow management guidelines that protect and/or restore habitat needs.

- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality.
- As a result of historical urbanization and the evolution from an agrarian society to an important port for whaling and commercial fishing, salt marshes and coastlines in the Buzzards Bay Watershed have been altered (soil erosion and silting from grazing and farming, construction of wharfs, piers, bridges) and tidal flushing has been reduced. Implement the salt marsh restoration projects identified and prioritized in the *2002 Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* (BBP 2002b).
- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and implementation of BMPs.
- All of the municipalities in the Buzzards Bay Watershed are Phase II communities and, as such, must apply for permit coverage for their municipal drainage system. This includes developing, implementing, and enforcing a storm water management program to reduce the discharge of pollutants from their system over the five-year permit term.
- Track the progress of CSO abatement activities and the facilities plan update for the City of New Bedford.
- Coordinate with the Massachusetts Department of Environmental Management, Six Ponds Association, and other groups conducting surveys of lakes and associated watersheds to generate quality-assured data (dissolved oxygen and temperature profiles, total phosphorus and chlorophyll *a*, fecal coliform bacteria, Secchi disk depth) to assess the designated uses. As part of any lake water quality evaluation include identification of non-native species and mapping of macrophyte cover in order to evaluate the status of the *Aquatic Life, Recreational, and Aesthetic uses*.
- Monitor and control the spread of non-native vegetation in aquatic and wetland habitats.
- When completed, implement recommendations identified in the *Cranberry Bog Phosphorus Dynamics TMDL Project* (DeMoranville 2001).
- Implement recommendations from diagnostic/feasibility studies including the D/F study for New Bedford Reservoir (ENSR 2002).
- Monitor the remediation activities and the water quality downgradient of the Tier 1A hazardous waste sites, including the following five EPA designated superfund sites: New Bedford Harbor, Massachusetts Military Reservation, Atlas Tack in Fairhaven, Re-Solve, Inc. in Dartmouth, and Sullivan's Ledge in New Bedford.
- Review the 2003 Buzzards Bay Stormwater Atlas when it becomes available from the Buzzards Bay National Estuary Project and implement recommended upgrades at the high priority storm water discharge sites.
- In April of 2003 Bouchard Barge 120 spilled oil in Buzzards Bay, affecting an estimated 94 miles of shoreline. If penalty money is assessed from Bouchard, potential recipients could include the Coalition for Buzzards Bay water quality monitoring program, which samples more than 30 waterbodies throughout the watershed, and the Turn the Tide Initiative, which will work to address nutrient enrichment and nonpoint source pollution in the Apponagansett Bay/Slocums River estuary.

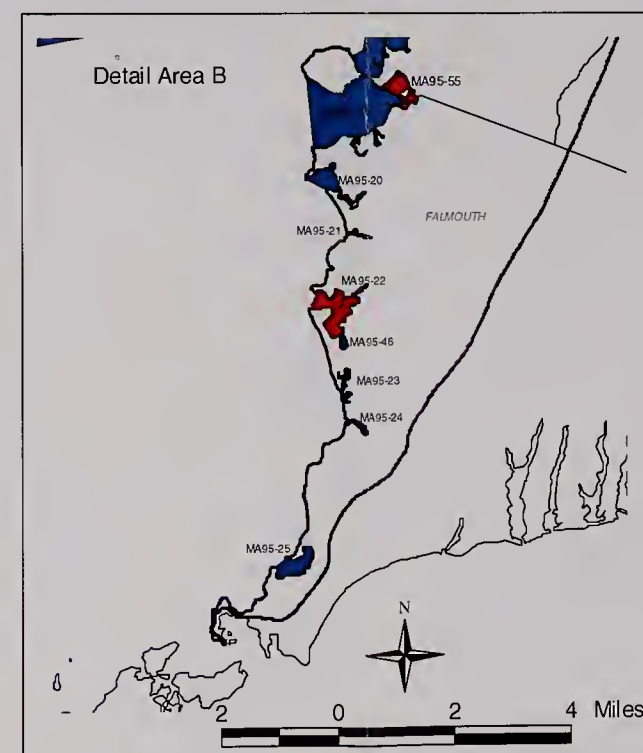
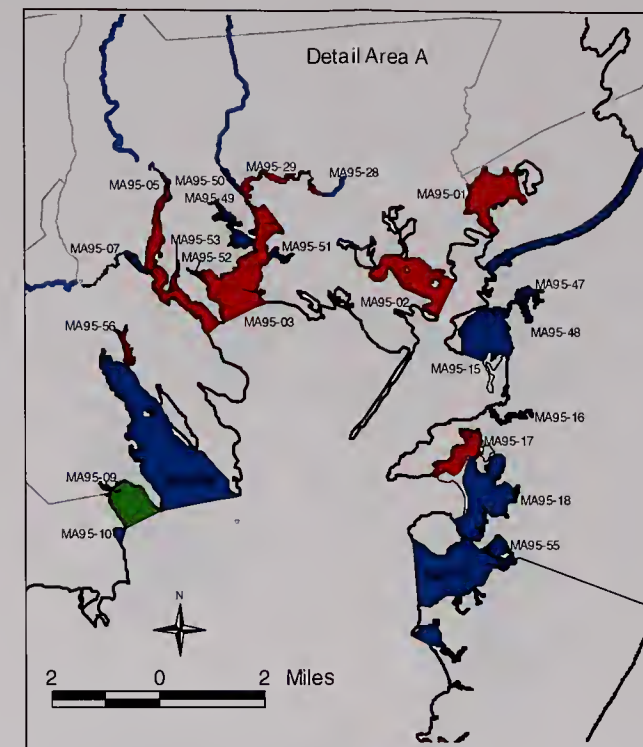
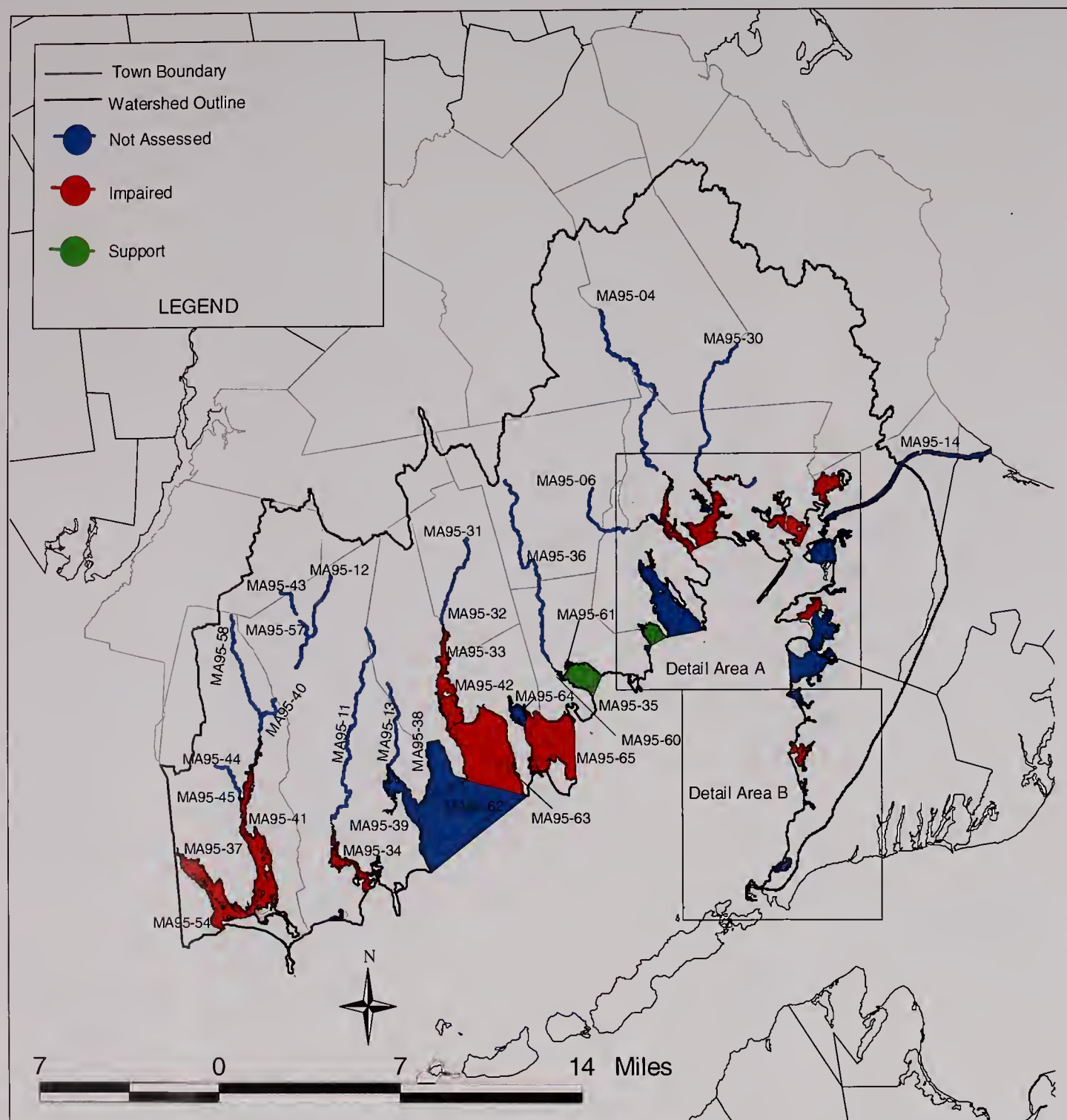
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Details of *Aquatic Life Use* impairments of river and estuary/coastal embayment segments in the Buzzards Bay Watershed.

| <u>Waterbody (WBID)</u> | <u>Causes</u> | <u>Sources</u> |
|---------------------------------------|---|---|
| Buttermilk Bay MA95-01 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Other anthropogenic substrate alterations, total nitrogen | Suspected: Recreational activities (boat traffic), highway/road runoff, urbanized high density area, municipal separate storm sewer systems |
| Onset Bay MA95-02 | Estuarine bioassessment (Loss/decline of eelgrass bed habitat) Suspected: Other anthropogenic substrate alterations, total nitrogen | Suspected: Recreational activities (boat traffic), highway/road runoff, urbanized high density area, municipal separate storm sewer systems |
| Wareham River MA95-03 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Total nitrogen | Municipal point source discharge Suspected: On-site treatment systems (septic systems), specialty crop production related to cranberry bogs |
| Weweantic River MA95-05 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Total nitrogen | Suspected: On-site treatment systems (septic systems), specialty crop production related to cranberry bogs, recreational activities (boat traffic) |
| Pocasset Harbor MA95-17 | Estuarine bioassessment (loss/decline of eelgrass bed habitat) Suspected: Other anthropogenic substrate alterations (resuspension of sediments), total nitrogen | Suspected: Recreational activities (boat traffic), highway/ road runoff |
| West Falmouth Harbor MA95-22 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Total nitrogen | On-site treatment systems (septic systems), septage disposal (landfill lagoon), municipal point source discharge (groundwater) |
| Agawam River MA95-29 | Ammonia (unionized), whole effluent toxicity | Municipal point source discharge Suspected: Irrigated, specialty crop production related to cranberry bogs and on-site treatment systems (septic systems) |
| Acushnet River MA95-33 | PCBs | Contaminated sediments, CERCLA NPL (Superfund site) |
| Slocums River MA95-34 | Estuarine bioassessment (loss of eelgrass bed habitat) Suspected: Total nitrogen | Suspected: On-site treatment systems (septic systems), urbanized high density area, municipal separate storm sewer systems, landfills |
| West Branch Westport River MA95-37 | Estuarine bioassessment (Loss/decline of eelgrass bed habitat) Suspected: Total nitrogen | Suspected: Animal feeding operation, municipal separate storm sewer systems, on- site septic systems |
| East Branch Westport River MA95-41 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Total nitrogen | Animal feeding operation, municipal separate storm sewer systems Suspected: On-site septic systems, changes in tidal circulation/flushing |
| New Bedford Inner Harbor MA95-42 | PCBs Suspected: Reduced tidal flushing, total nitrogen | Contaminated sediments, CERCLA NPL (Superfund site) Suspected: Changes in tidal circulation/flushing, CSO, urbanized high-density area, municipal point source discharge |
| Beaverdam Creek MA95-53 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Total nitrogen | Suspected: On-site treatment systems (septic systems), specialty crop production related to cranberry bogs |
| Westport River MA95-54 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Total nitrogen, other anthropogenic substrate alterations | Suspected: Animal feeding operation, municipal separate storm sewer systems, on-site septic systems |
| Hammett Cove MA95-56 | Estuarine bioassessment (Decline of eelgrass bed habitat) Suspected: Total nitrogen | Suspected: On-site treatment systems (septic systems), residential districts/lawns |
| Outer New Bedford Harbor MA95-63 | Estuarine bioassessment (loss of eelgrass bed habitat) Suspected: Total nitrogen, other anthropogenic substrate alterations | Suspected: CSO, urbanized high density area, municipal separate storm sewer systems |



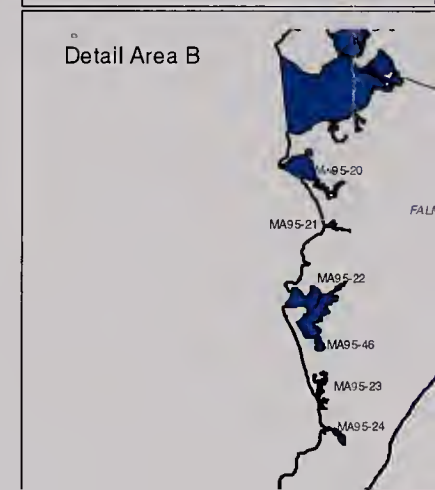
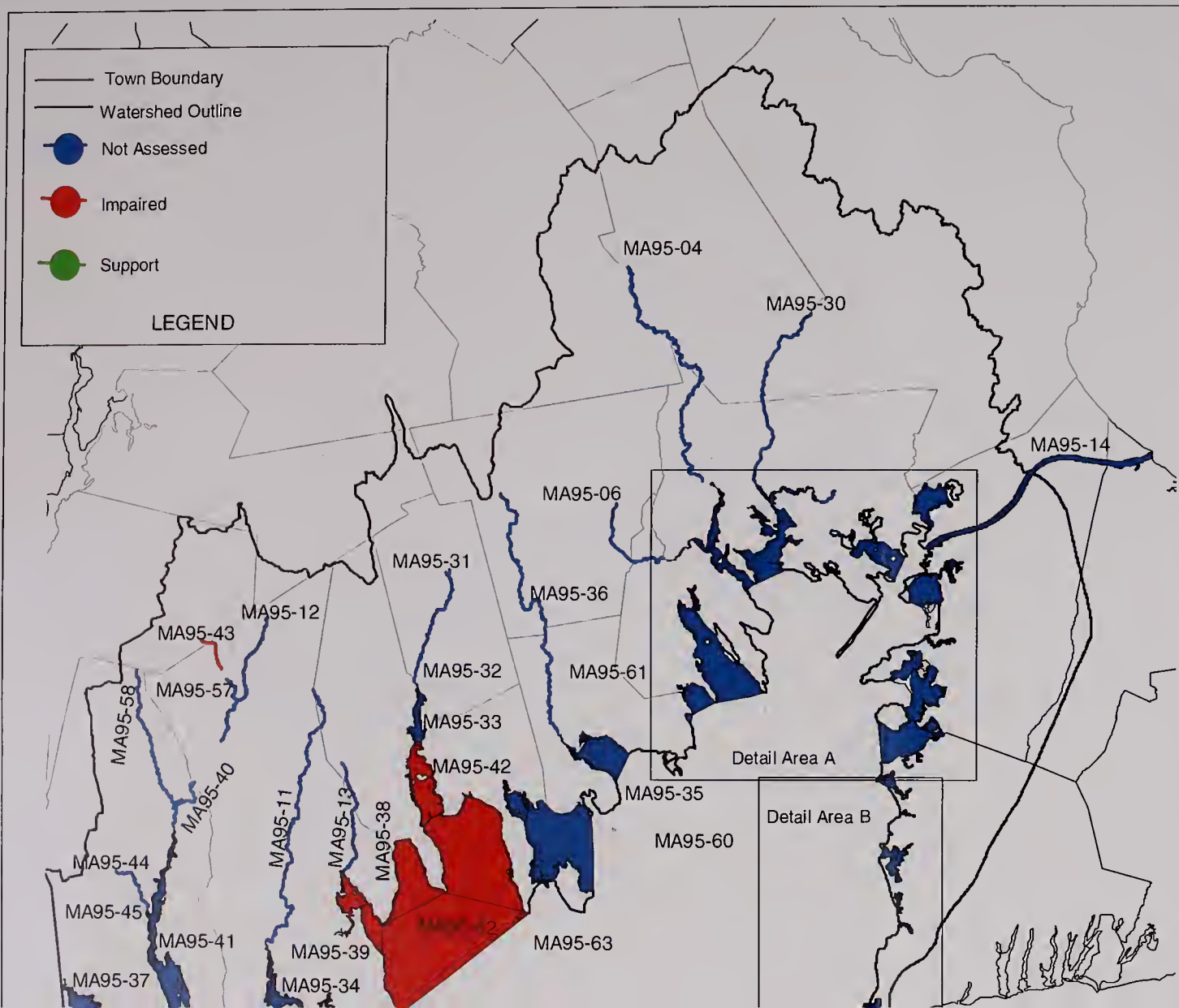
**Figure 1. BUZZARDS BAY WATERSHED
AQUATIC LIFE USE ASSESSMENT SUMMARY
RIVERS AND ESTUARIES/COASTAL EMBAYMENTS**



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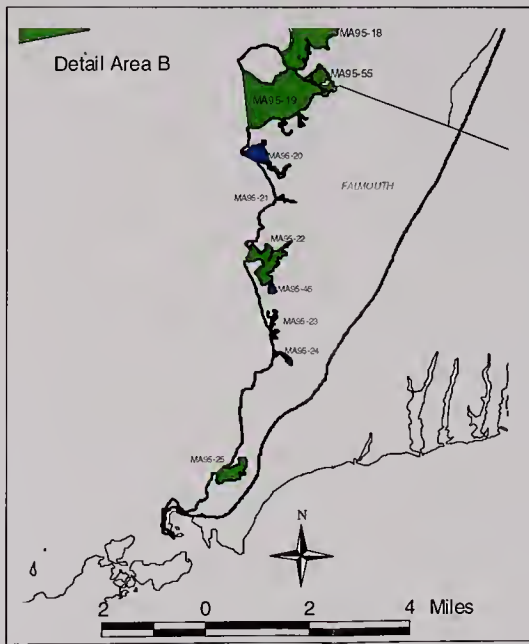
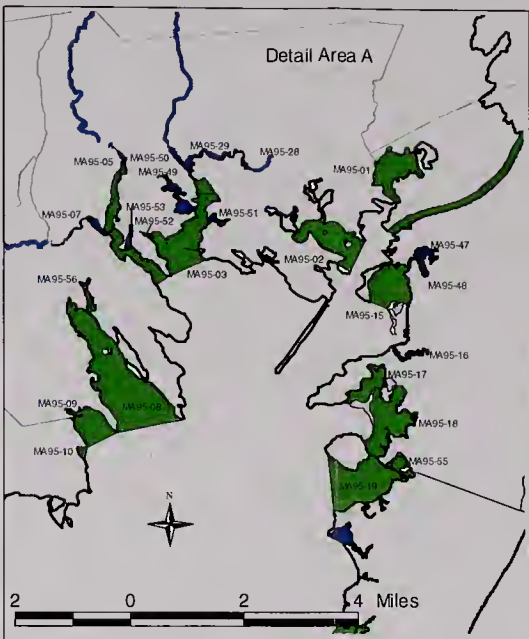
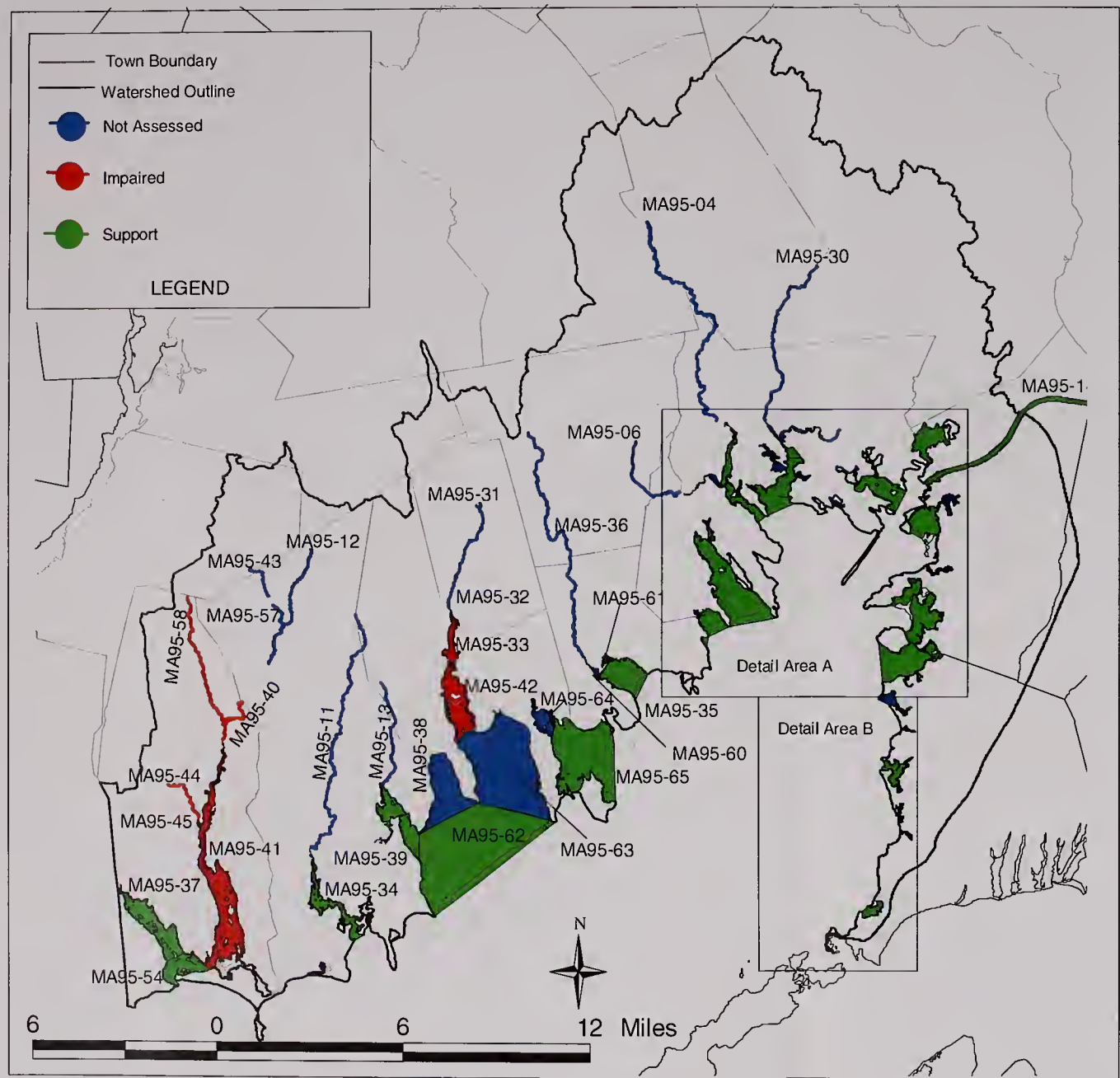
Figure 2. BUZZARDS BAY WATERSHED
FISH CONSUMPTION USE ASSESSMENT SUMMARY
RIVERS AND ESTUARIES/COASTAL EMBAYMENTS

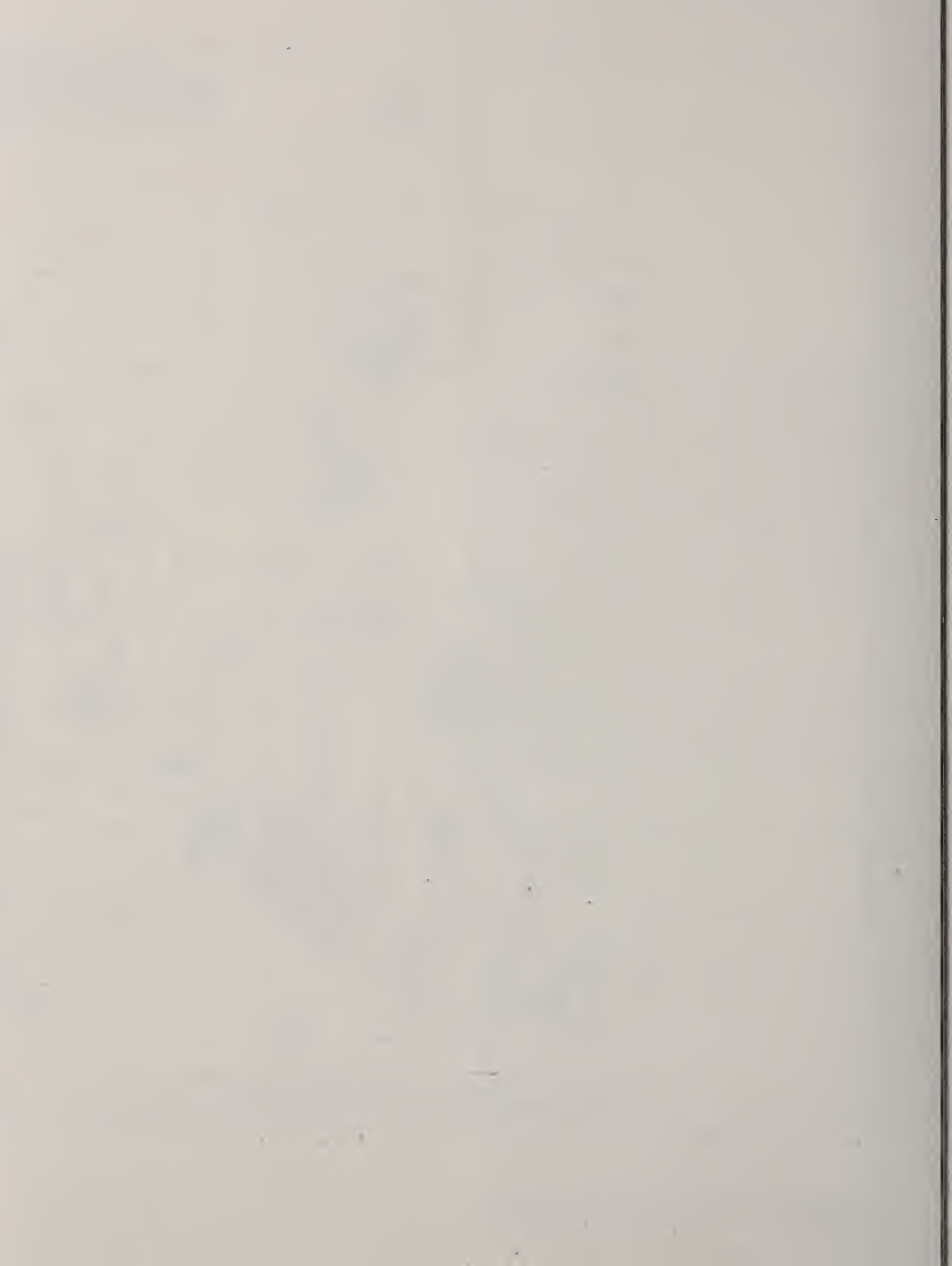


In July 2001, the Massachusetts Department of Public Health issued new consumer advisories on fish consumption and mercury contamination. The MDPH "is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)." Additionally, MDPH "is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)." MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Due to the statewide advisory, no waterbody in Massachusetts can be assessed as Support for the *Fish Consumption Use*.

In the Buzzards Bay Watershed, MDPH issued site specific fish consumption advisories for the Copicut River (MA95-11) due to elevated levels of mercury and PCBs in edible fillets of fish and for Clarks Cove (MA95-38), Apponagansett Bay (MA95-39), New Bedford Inner Harbor (MA95-42), Open Water (MA95-62), and Outer New Bedford Harbor (MA95-63) due to PCBs. Therefore, the *Fish Consumption Use* is Impaired. Sources of PCB impairment include contaminated sediments and Superfund Sites. Atmospheric deposition is a suspected source of mercury.

**Figure 3. BUZZARDS BAY WATERSHED
PRIMARY AND SECONDARY CONTACT RECREATIONAL USES
ASSESSMENT SUMMARY
RIVERS AND ESTUARIES/COASTAL EMBAYMENTS**





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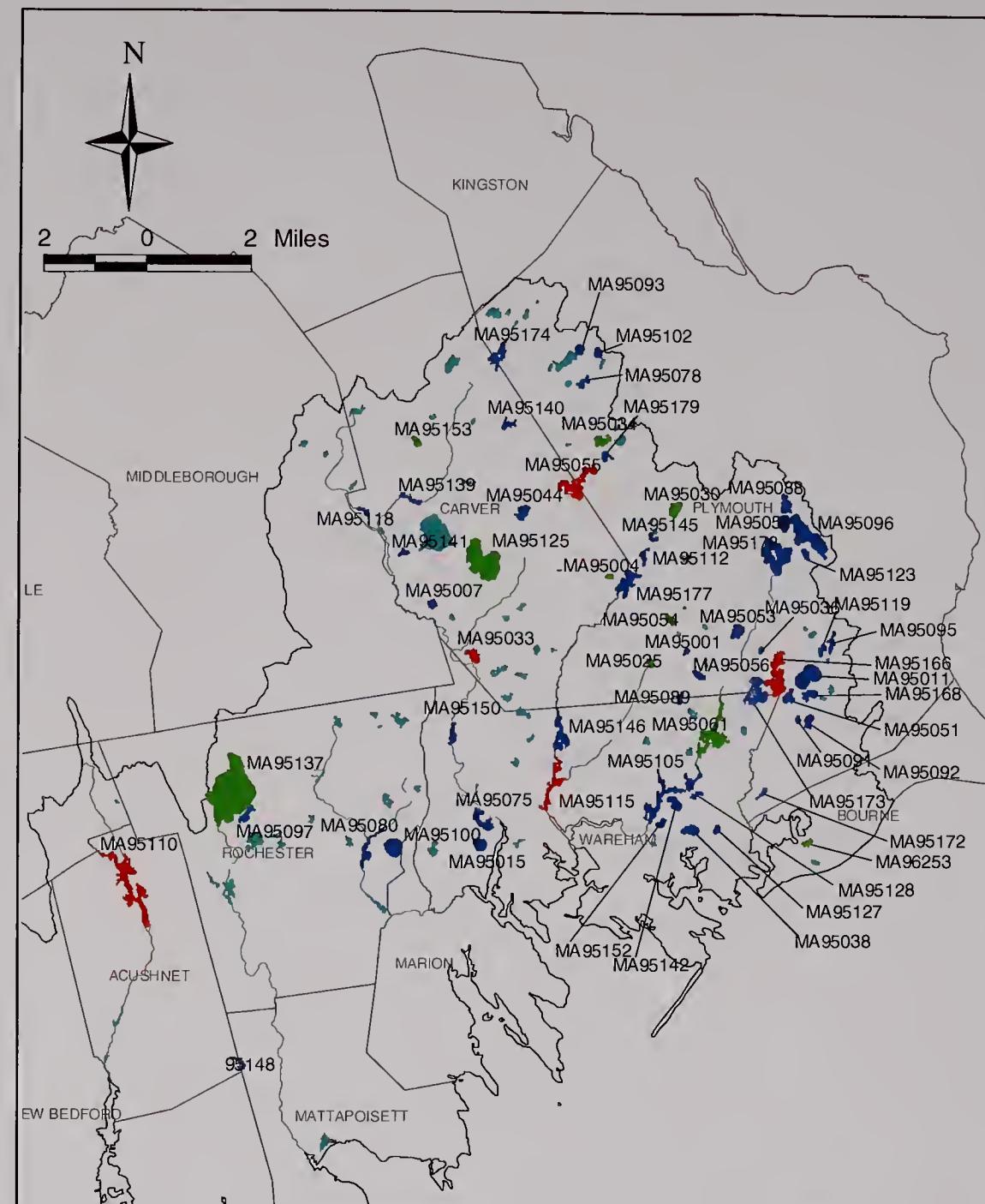
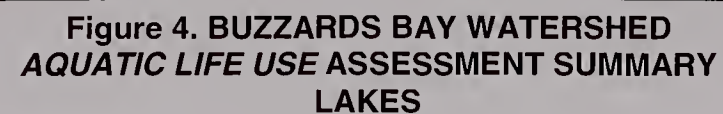
Details of Impairment of the *Primary* and *Secondary Contact Recreational uses* and the *Aesthetics Use* for river and estuary/coastal embayment segments in the Buzzards Bay Watershed.

NOTES: 1° = Primary Contact; 2° = Secondary Contact. *The Aesthetics Use is assessed as Support in one segment, MA95-04, and as IMPAIRED in two segments, MA95-33 and MA95-42 due to oil & grease, odor, color, trash and debris. Because the *Aesthetics Use* is impaired, the *Primary and Secondary Contact uses* are also impaired. Sources include CSO and urbanized high-density areas. Suspected sources in MA95-42 include shipbuilding, repairs, dry-docking, and ballast water releases.

| <u>Waterbody (WBID)</u> | <u>Use Assessment</u> | <u>Causes</u> | <u>Source</u> |
|---|---|--|---|
| Acushnet River (MA95-33)* | 1°, 2°- IMPAIRED | Oil & grease, odor, color, trash and debris | CSO, urbanized high density area |
| East Branch Westport River (MA95-40) | 1° -IMPAIRED 2°- 2.53 miles SUPPORT 0.32 miles IMPAIRED | Fecal coliform bacteria | Suspected: Municipal separate storm sewer systems, highway/road runoff |
| East Branch Westport River (MA95-41) | 1°, 2°- 2.43 mi ² SUPPORT 1°, 2°- 0.22 mi ² IMPAIRED | Fecal Coliform Bacteria | Animal feeding operation, dairy outside milk parlor area, grazing in riparian zone, municipal separate storm sewer systems Suspected: On-site septic systems highway/road runoff |
| New Bedford Inner Harbor (MA95-42)* | 1°, 2°- IMPAIRED | Oil & grease, odor, trash and debris | CSO, urbanized high density area Suspected: Waterfowl |
| Snell Creek (MA95-44) | 1°, 2°- IMPAIRED | Fecal coliform bacteria | Suspected: Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |
| Bread and Cheese Brook (MA95-58) | 1°, 2°- IMPAIRED | Fecal coliform bacteria | Suspected: Municipal separate storm sewer systems, grazing in riparian zone, highway/road runoff |
| Snell Creek (MA95-59) | 1°, 2°- IMPAIRED | Fecal Coliform Bacteria | Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area Suspected: Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |

The following estuaries/coastal embayments in the Buzzards Bay Watershed have been assessed as SUPPORT for a portion of their area:

| | | | |
|---------------------------------|---|---------------------------------------|---|
| Buttermilk Bay MA95-01 | 1°, 2°- 0.51 mi ² SUPPORT 1°, 2°- 0.16 mi ² NOT ASSESSED | Onset Bay MA95-02 | 1°, 2°- 0.63 mi ² SUPPORT 1°, 2°- 0.15 mi ² NOT ASSESSED |
| Wareham River MA95-03 | 1°, 2°- 0.93 mi ² SUPPORT 1°, 2°- 0.25 mi ² NOT ASSESSED | Weweantic River MA95-05 | 1°, 2°- 0.17 mi ² SUPPORT 1°, 2°- 0.45 mi ² NOT ASSESSED |
| Aucoot Cove MA95-09 | 1°, 2°- 0.46 mi ² SUPPORT 1°, 2°- 0.04 mi ² NOT ASSESSED | Hiller Cove MA95-10 | 1°, 2°- 0.03 mi ² SUPPORT 1°, 2°- 0.01 mi ² NOT ASSESSED |
| Cape Cod Canal MA95-14 | 1°, 2°- 0.58 mi ² SUPPORT 1°, 2°- 0.15 mi ² NOT ASSESSED | Pocasset Harbor MA95-17 | 1°, 2°- 0.2 mi ² SUPPORT 1°, 2°- 0.13 mi ² NOT ASSESSED |
| Red Brook Harbor MA95-18 | 1°, 2°- 0.8 mi ² SUPPORT 1°, 2°- 0.11 mi ² NOT ASSESSED | West Falmouth Harbor MA95-22 | 1°, 2°- 0.09 mi ² SUPPORT 1°, 2°- 0.2 mi ² NOT ASSESSED |
| Quissett Harbor MA95-25 | 1°, 2°- 0.11 mi ² SUPPORT 1°, 2°- 0.06 mi ² NOT ASSESSED | Slocums River MA95-34 | 1°, 2°- 0.01 mi ² SUPPORT 1°, 2°- 0.66 mi ² NOT ASSESSED |
| Mattapoissett Harbor MA95-35 | 1°, 2°- 1.00 mi ² SUPPORT 1°, 2°- 0.01 mi ² NOT ASSESSED | West Branch Westport River MA95-37 | 1°, 2°- 0.5 mi ² SUPPORT 1°, 2°- 0.78 mi ² NOT ASSESSED |
| Apponagansett Bay MA95-39 | 1°, 2°- 0.27 mi ² SUPPORT 1°, 2°- 0.68 mi ² NOT ASSESSED | Hammet Cove MA95-56 | 1°, 2°- 0.05 mi ² SUPPORT 1°, 2°- 0.02 mi ² NOT ASSESSED |
| Open Water MA95-62 | 1°, 2°- 4.82 mi ² SUPPORT 1°, 2°- 3.2 mi ² NOT ASSESSED | Nasketucket Bay MA95-65 | 1°, 2°- 3.2 mi ² SUPPORT 1°, 2°- 0.5 mi ² NOT ASSESSED |



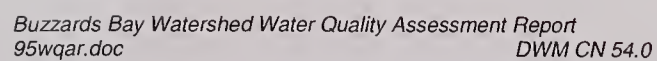
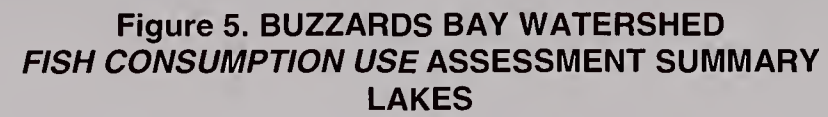
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Details of *Aquatic Life Use* impairments of lake segments in the Buzzards Bay Watershed.

Waterbody (WBID)

Causes

| | |
|------------------------------------|--|
| Carver Brook Bog Pond (MA95033) | Non-native plants, phosphate, excess algal growth |
| Federal Pond (MA95055) | Non-native plants |
| Fresh Meadow Pond (MA95174) | Non-native plants |
| Mill Pond (MA95105) | Non-native plants |
| New Bedford Reservoir (MA95110) | Non-native plants, DO, DO saturation, phosphate |
| Noquochoke Lake (MA95113) | Non-native plants |
| Noquochoke Lake (MA95170) | Non-native plants |
| Noquochoke Lake (MA95171) | Non-native plants |
| Parker Mills Pond (MA95115) | Non-native plants, phosphate |
| Sampson Pond (MA95125) | Non-native plants |
| Tremont Mill Pond (MA95150) | Non-native plants |
| White Island Pond (East) (MA95166) | Non-native plants, phosphate, excess algal growth, chlorophyll a |
| White Island Pond (West) (MA95173) | Non-native plants |



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In July 2001, the Massachusetts Department of Public Health issued new consumer advisories on fish consumption and mercury contamination. The MDPH "is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)." Additionally, MDPH "is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001b)." MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Due to the statewide advisory, no waterbody in Massachusetts can be assessed as Support for the *Fish Consumption Use*. Atmospheric deposition is suspected as a source of mercury. PCBs contamination is associated with the ReSolve Superfund Site.

| <u>Waterbody</u> | <u>WBID</u> | <u>Cause</u> |
|------------------|-------------|---------------|
| Cornell Pond | MA95031 | Mercury, PCBs |
| Long Pond | MA95097 | Mercury |
| Noquochoke Lake | MA95113 | Mercury, PCBs |
| Noquochoke Lake | MA95170 | Mercury, PCBs |
| Noquochoke Lake | MA95171 | Mercury, PCBs |
| Snipatuit Pond | MA95137 | Mercury |
| Turner Pond | MA95151 | Mercury |

Details of impairment of the *Primary* and *Secondary Contact Recreational uses* and the *Aesthetics Use* for lake segments in the Buzzards Bay Watershed.

NOTES: 1° = Primary Contact; 2° = Secondary Contact. Turner Pond, New Bedford/Dartmouth (MA95112) is the only pond assessed as SUPPORT for the Aesthetics Use.

| <u>Waterbody</u> | <u>WBID</u> | <u>Use Assessment</u> | <u>Causes</u> |
|--------------------------|-------------|---|--|
| Crane Brook Bog Pond | MA95033 | 1°, 2°, Aesthetics- IMPAIRED | Excess algal growth |
| Federal Pond | MA95055 | 1°, 2°, Aesthetics- IMPAIRED | Non-native plants |
| New Bedford Reservoir | MA95110 | 1°, 2° - IMPAIRED Aesthetics- IMPAIRED | Non-native plants, phosphate Phosphate |
| Parker Mills Pond | MA95115 | 1°, 2°, Aesthetics- IMPAIRED | Non-native plants, phosphate |
| White Island Pond (East) | MA95166 | 1°, 2°, Aesthetics- IMPAIRED | Excess algal growth, Secchi disk transparency, phosphate |

INTRODUCTION

The Massachusetts Watershed Approach is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed. The mission is to improve water quality conditions and to provide a framework under which the restoration and/or protection of the watershed's natural resources can be achieved. Figure 7 illustrates the management structure to carry out the mission. This report presents the current assessment of water quality conditions in the Buzzards Bay Watershed. The assessment is based on information that has been researched and developed by the Massachusetts Department of Environmental Protection (MA DEP) through the first three years (information gathering, monitoring, and assessment) of the five-year cycle in partial fulfillment of MA DEP's federal mandate to report on the status of the Commonwealth's waters under the Federal Water Pollution Control Act (commonly known as the Clean Water Act [CWA]).

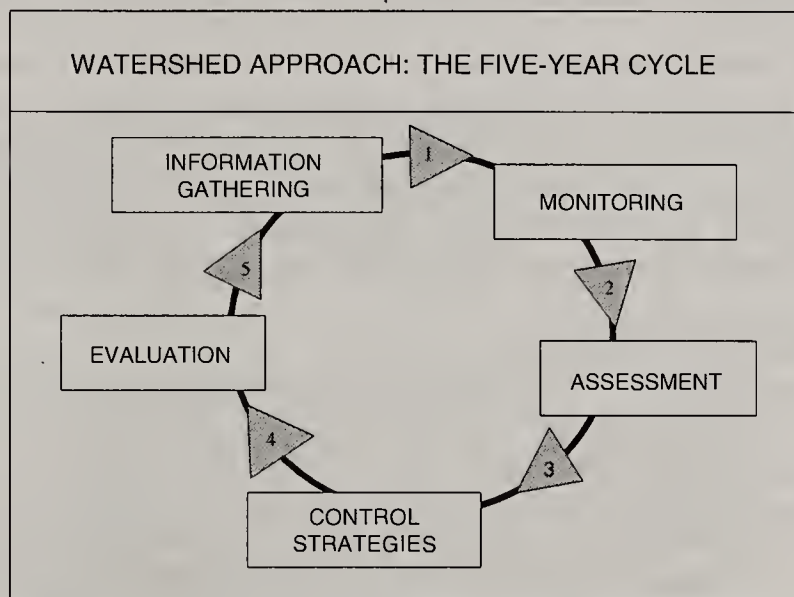


Figure 7: Five-year cycle of the Watershed Approach.

The goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this objective, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the United States Environmental Protection Agency (EPA), the United States Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, every two years MA DEP must submit a statewide report (to the EPA) that describes the status of water quality in the Commonwealth. Up until 2002, this was accomplished as the statewide Summary Of Water Quality (the 305(b) Report). States are also required to submit, under Section 303(d) of the CWA, a List Of Waters requiring a total maximum daily load (TMDL) calculation. In 2002, however, EPA required the states to combine elements of the statewide 305(b) Report and the Section 303(d) List Of Waters into one "Integrated List of Waters". This statewide list is based on the compilation of information for the Commonwealth's 27 watersheds. Massachusetts has opted to write individual watershed water quality assessment reports and use them as the supporting documentation for the Integrated List. The assessment reports utilize data compiled from a variety of sources and provide an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the watershed level. Instream biological, habitat, physical/chemical, toxicity data and other information are evaluated to assess the status of water quality conditions. This analysis follows a standardized process described below (Assessment Methodology). Once the use assessments have been completed, the segments are categorized for the Integrated List.

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MA DEP 1996a). These regulations should undergo public review every three years. The surface waters are segmented and each segment is assigned to one of the six classes described below. Each class is identified by the most sensitive and, therefore, governing water uses to be achieved and protected. Surface waters may be suitable for other beneficial uses, but shall be regulated by the Department of Environmental Protection to protect and enhance the designated uses.

Inland Water Classes

1. **Class A** – *These waters are designated as a source of public water supply. To the extent compatible with this use they shall be an excellent habitat for fish, other aquatic life and wildlife, and suitable for primary and secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORWs) under 314 Code of Massachusetts Regulations (CMR) 4.04(3).*
2. **Class B** – *These waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.*
3. **Class C** – *These waters are designated as a habitat for fish, other aquatic life and wildlife, and for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking and for compatible industrial cooling and process uses. These waters shall have good aesthetic value.*

Coastal and Marine Classes

4. **Class SA** – *These waters are designated as an excellent habitat for fish, other aquatic life and wildlife and for primary and secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value.*
5. **Class SB** – *These waters are designated as a habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.*
6. **Class SC** – *These waters are designated as a habitat for fish, other aquatic life, and wildlife and for secondary contact recreation. They shall also be suitable for certain industrial cooling and process uses. These waters shall have good aesthetic value.*

The CWA Section 305(b) water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. In so doing, the states report on waterbodies within the context of meeting their designated uses (described above in each class). Each class is identified by the most sensitive and, therefore, governing water uses to be achieved and protected. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary Contact Recreation, Secondary Contact Recreation, Shellfish Harvesting and Aesthetics*. Two subclasses of Aquatic Life are also designated in the standards: Cold Water Fishery (capable of sustaining a year-round population of cold water aquatic life, such as trout) and Warm Water Fishery (waters that are not capable of sustaining a year-round population of cold water aquatic life).

The SWQS, summarized in Table 1, prescribes minimum water quality criteria to sustain the designated uses. Furthermore, these standards describe the hydrological conditions at which water quality criteria must be applied (MA DEP 1996a). In rivers, the lowest flow conditions at and above which aquatic life

criteria must be applied are the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In artificially regulated waters, the lowest flow conditions at which aquatic life criteria must be applied are the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow that has been agreed upon. In coastal and marine waters and for lakes the most severe hydrological condition for which the aquatic life criteria must be applied shall be determined by MA DEP on a case-by-case basis.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any organization, performing work for or on behalf of EPA, establishes a quality system to support the development, review, approval, implementation, and assessment of data collection operations. To this end, MA DEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or compiled by the agency are of known and documented quality and are suitable for their intended use. For external sources of information, MA DEP requires the following: 1. an appropriate *Quality Assurance Project Plan* including a laboratory Quality Assurance /Quality Control (QA/QC) plan, 2. use of a state certified lab (or as otherwise approved by DEP for a particular analysis), and 3. sample data, QA/QC and other pertinent sample handling information are documented in a citable report. This information will be reviewed by MA DEP to determine its validity and usability to assess water use support. Data use could be modified or rejected due to poor or undocumented QAPP implementation, lack of project documentation, incomplete reporting of data or information, and/or project monitoring objectives unsuitable for MA DEP assessment purposes.

EPA provides guidelines to the States for making their use support determinations (EPA 1997 and 2002, Grubbs and Wayland III 2000 and Wayland III 2001). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered “historical” and used for descriptive purposes, they can be utilized in the use support determination provided they are known to reflect the current conditions. While the water quality standards (Table 1) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance in the literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* 1993 by D. Persaud, R. Jaagumagi and A. Hayton). Excursions from criteria due to solely “naturally occurring” conditions (e.g., low pH in some areas) do not constitute violations of the standards.

Each designated use within a given segment is individually assessed as **support** or **impaired**. When too little current data/information exists or no reliable data are available, the use is **not assessed**. In this report, however, if there is some indication that water quality impairment may exist, which is not “naturally occurring”, the use is identified with an “Alert Status”. Detailed guidance for assessing the status of each use follows in the Designated Uses Section of this report. It is important to note that not all waters are assessed. Many small and/or unnamed ponds, rivers, and estuaries are currently **unassessed**; the status of their designated uses has never been reported to EPA in the Commonwealth’s 305(b) report or the Integrated List of Waters nor is information on these waters maintained in the waterbody system database (WBS) or the new assessment database (ADB).

Table 1. Summary of Massachusetts Surface Water Quality Standards (MA DEP 1996a and MDPH 2002a).

| | |
|---------------------|---|
| Dissolved Oxygen | <p><u>Class A, Class B Cold Water Fishery (BCWF), and Class SA:</u> ≥ 6.0 mg/L and $\geq 75\%$ saturation unless background conditions are lower</p> <p><u>Class B Warm Water Fishery (BWFF) and Class SB:</u> ≥ 5.0 mg/L and $\geq 60\%$ saturation unless background conditions are lower</p> <p><u>Class C:</u> Not ≤ 5.0 mg/L for more than 16 of any 24-hour period and not ≤ 3.0 mg/L anytime unless background conditions are lower; levels cannot be lowered below 50% saturation due to a discharge</p> <p><u>Class SC:</u> Not ≤ 5.0 mg/L for more than 16 of any 24-hour period and not ≤ 4.0 mg/L anytime unless background conditions are lower; and 50% saturation; levels cannot be lowered below 50% saturation due to a discharge</p> |
| Temperature | <p><u>Class A:</u> $\leq 68^{\circ}\text{F}$ (20°C) and $\Delta 1.5^{\circ}\text{F}$ (0.8°C) for Cold Water and $\leq 83^{\circ}\text{F}$ (28.3°C) and $\Delta 1.5^{\circ}\text{F}$ (0.8°C) for Warm Water.</p> <p><u>Class BCWF:</u> $\leq 68^{\circ}\text{F}$ (20°C) and $\Delta 3^{\circ}\text{F}$ (1.7°C) due to a discharge</p> <p><u>Class BWFF:</u> $\leq 83^{\circ}\text{F}$ (28.3°C) and $\Delta 3^{\circ}\text{F}$ (1.7°C) in lakes, $\Delta 5^{\circ}\text{F}$ (2.8°C) in rivers</p> <p><u>Class C and Class SC:</u> $\leq 85^{\circ}\text{F}$ (29.4°C) nor $\Delta 5^{\circ}\text{F}$ (2.8°C) due to a discharge</p> <p><u>Class SA:</u> $\leq 85^{\circ}\text{F}$ (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and $\Delta 1.5^{\circ}\text{F}$ (0.8°C)</p> <p><u>Class SB:</u> $\leq 85^{\circ}\text{F}$ (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and $\Delta 1.5^{\circ}\text{F}$ (0.8°C) between July through September and $\Delta 4.0^{\circ}\text{F}$ (2.2°C) between October through June</p> |
| pH | <p><u>Class A, Class BCWF and Class BWFF:</u> 6.5 - 8.3 SU and $\Delta 0.5$ outside the background range.</p> <p><u>Class C:</u> 6.5 - 9.0 SU and $\Delta 1.0$ outside the naturally occurring range.</p> <p><u>Class SA and Class SB:</u> 6.5 - 8.5 SU and $\Delta 0.2$ outside the normally occurring range.</p> <p><u>Class SC:</u> 6.5 - 9.0 SU and $\Delta 0.5$ outside the naturally occurring range.</p> |
| Solids | <p><u>All Classes:</u> <i>These waters shall be free from floating, suspended, and settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.</i></p> |
| Color and Turbidity | <p><u>All Classes:</u> <i>These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.</i></p> |
| Oil and Grease | <p><u>Class A and Class SA:</u> <i>Waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.</i></p> <p><u>Class SA:</u> <i>Waters shall be free from oil and grease and petrochemicals.</i></p> <p><u>Class B, Class C, Class SB and Class SC:</u> <i>Waters shall be free from oil and grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.</i></p> |
| Taste and Odor | <p><u>Class A and Class SA:</u> <i>None other than of natural origin.</i></p> <p><u>Class B, Class C, Class SB and Class SC:</u> <i>None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.</i></p> |
| Aesthetics | <p><u>All Classes:</u> <i>All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.</i></p> |
| Toxic Pollutants | <p><u>All Classes:</u> <i>All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife... The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established.</i></p> |
| Nutrients | <p><i>Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.</i></p> |

Note: Italics are direct quotations.

Δ criterion (referring to a change from natural background conditions) is applied to the effects of a permitted discharge.

Table 1 (Continued). Summary of Massachusetts Surface Water Quality Standards (MA DEP 1996a and MDPH 2002a).

| | |
|---|--|
| <p>Bacteria (MDPH 2002a) Minimum Standards for Bathing Beaches State Sanitary Code and MA DEP 1996a</p> <p>Class A criteria apply to the <i>Drinking Water Use</i>.</p> <p>Class B and SB criteria apply to <i>Primary Contact Recreation Use</i> while Class C and SC criteria apply to <i>Secondary Contact Recreation Use</i>.</p> | <p><u>Class A:</u></p> <ul style="list-style-type: none"> Fecal coliform bacteria: An arithmetic mean of <20 CFU/100mL in any representative set of samples and <10% of the samples >100 CFU/100mL. <p><u>Class B:</u></p> <ul style="list-style-type: none"> At public bathing beaches, as defined by MDPH, where <i>E. coli</i> is the chosen indicator: No single <i>E. coli</i> sample shall exceed 235 <i>E. coli</i> /100 mL and the geometric mean of the most recent five <i>E. coli</i> samples within the same bathing season shall not exceed 126 <i>E. coli</i> / 100 mL. At public bathing beaches, as defined by MDPH, where <i>Enterococci</i> are the chosen indicator: No single <i>Enterococci</i> sample shall exceed 61 <i>Enterococci</i> /100mL and the geometric mean of the most recent five <i>Enterococci</i> samples within same bathing season shall not exceed 33 <i>Enterococci</i> /100mL. Current standards for other waters (not designated as bathing beaches), where fecal coliform bacteria are the chosen indicator: Waters shall not exceed a geometric mean of 200 CFU/100mL in any representative set of samples, nor shall more than 10% of the samples exceed 400 CFU/100mL. (This criterion may be applied on a seasonal basis at the discretion of the MA DEP.) <p><u>Class C:</u></p> <ul style="list-style-type: none"> Fecal coliform bacteria: Shall not exceed a geometric mean of 1000 CFU/100mL, nor shall 10% of the samples exceed 2000 CFU/100 mL. <p><u>Class SA:</u></p> <ul style="list-style-type: none"> Fecal coliform bacteria: Waters approved for open shellfishing shall not exceed a geometric mean (most probable number (MPN) method) of 14 MPN/100 mL, nor shall more than 10% of the samples exceed 43 MPN/100mL. At public bathing beaches, as defined by MDPH, where <i>Enterococci</i> are the chosen indicator: No single <i>Enterococci</i> sample shall exceed 104 <i>Enterococci</i> /100mL and the geometric mean of the five most recent <i>Enterococci</i> levels within the same bathing season shall not exceed 35 <i>Enterococci</i> /100mL. Current standards for other waters (not designated as shellfishing areas or public bathing beaches), where fecal coliform bacteria are the chosen indicator: Waters shall not exceed a geometric mean of 200 CFU/100mL in any representative set of samples, nor shall more than 10% of the samples exceed 400 CFU/100mL. (This criterion may be applied on a seasonal basis at the discretion of the MA DEP.) <p><u>Class SB:</u></p> <ul style="list-style-type: none"> Fecal coliform bacteria: In waters approved for restricted shellfish, a fecal coliform median or geometric mean (MPN method) of <88 MPN/100mL and <10% of the samples >260 MPN/100mL. At public bathing beaches, as defined by MDPH, where <i>Enterococci</i> are the chosen indicator: No single <i>Enterococci</i> sample shall exceed 104 <i>Enterococci</i> /100mL and the geometric mean of the most recent five <i>Enterococci</i> levels within the same bathing season shall not exceed 35 <i>Enterococci</i> /100mL. Current standards for other waters (not designated as shellfishing areas or public bathing beaches), where fecal coliform bacteria are the chosen indicator: Waters shall not exceed a geometric mean of 200 CFU/100mL in any representative set of samples, nor shall more than 10% of the samples exceed 400 CFU/100mL. (This criterion may be applied on a seasonal basis at the discretion of the MA DEP.) <p><u>Class SC:</u></p> <ul style="list-style-type: none"> Fecal coliform bacteria: Shall not exceed a geometric mean of 1000 CFU/100mL, nor shall 10% of the samples exceed 2000 CFU/100mL. |
|---|--|

DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MA DEP 1996a):

- *AQUATIC LIFE* - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Two subclasses of aquatic life are also designated in the standards for freshwater bodies: *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life, such as trout; *Warm Water Fishery* - waters that are not capable of sustaining a year-round population of cold water aquatic life.
- *FISH CONSUMPTION* - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption.
- *DRINKING WATER* - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).
- *SHELLFISH HARVESTING* (in SA and SB segments) – Class SA waters in approved areas (Open Shellfish Areas) shellfish harvested without depuration shall be suitable for consumption; Class SB waters in approved areas (Restricted Shellfish Areas) shellfish harvested with depuration shall be suitable for consumption.
- *PRIMARY CONTACT RECREATION* - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.
- *SECONDARY CONTACT RECREATION* - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.
- *AESTHETICS* - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *AGRICULTURAL AND INDUSTRIAL* - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

The guidance used to assess the *Aquatic Life*, *Fish Consumption*, *Drinking Water*, *Shellfish Harvesting*, *Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows.

AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the MA DEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support or impaired) of the *Aquatic Life Use*:

| Variable | Support - Data available clearly indicates support or minor modification of the biological community. Excursions from chemical criteria (Table 1) not frequent or prolonged and may be tolerated if the biosurvey results demonstrate support. | Impaired There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community. |
|---|---|--|
| BIOLOGY | | |
| Rapid Bioassessment Protocol (RBP) III* | Non/Slightly impacted | Moderately or Severely Impacted |
| Fish Community | Best Professional Judgment (BPJ) | BPJ |
| Habitat and Flow | BPJ | Dewatered streambed due to artificial regulation or channel alteration, BPJ |
| Eelgrass Bed Habitat (Howes <i>et al.</i> 2002) | Stable (No/minimal loss), BPJ | Loss/decline, BPJ |
| Macrophytes | BPJ | Exotic species present, BPJ |
| Plankton/Periphyton | No/infrequent algal blooms | Frequent and/or prolonged algal blooms |
| TOXICITY TESTS** | | |
| Water Column/Ambient | ≥75% survival either 48 hr or 7-day exposure | <75% survival either 48 hr or 7-day exposure |
| Sediment | ≥75% survival | <75% survival |
| CHEMISTRY-WATER** | | |
| Dissolved oxygen (DO)/percent saturation (MA DEP 1996a, EPA 1997) | Infrequent excursion from criteria (Table 1), BPJ (minimum of three samples representing critical period) | Frequent and/or prolonged excursion from criteria [river and shallow lakes: exceedances >10% of measurements; deep lakes (with hypolimnion): exceedances in the hypolimnetic area >10% of the surface area]. |
| pH (MA DEP 1996a, EPA 19 November 1999) | Infrequent excursion from criteria (Table 1) | Criteria exceeded >10% of measurements. |
| Temperature (MA DEP 1996, EPA 1997) | Infrequent excursion from criteria (Table 1) ¹ | Criteria exceeded >10% of measurements. |
| Toxic Pollutants (MA DEP 1996a, EPA 19 November 1999) Ammonia-N (MA DEP 1996a, EPA 1999) Chlorine (MA DEP 1996, EPA 19 November 1999) | Infrequent excursion from criteria (Table 1) Ammonia is pH and temperature dependent ² 0.011 mg/L (freshwater) or 0.0075 mg/L (saltwater) total residual chlorine (TRC) ³ | Frequent and/or prolonged excursion from criteria (exceeded >10% of measurements). |
| CHEMISTRY-SEDIMENT** | | |
| Toxic Pollutants (Persaud <i>et al.</i> 1993) | Concentrations ≤ Low Effect Level (L-EL), BPJ | Concentrations ≥ Severe Effect Level (S-EL) ⁴ , BPJ |
| CHEMISTRY-TISSUE | | |
| PCB – whole fish (Coles 1998) | ≤500 µg/kg wet weight | BPJ |
| DDT (Environment Canada 04 November 1999) | ≤14.0 µg/kg wet weight | BPJ |
| PCB in aquatic tissue (Environment Canada 04 November 1999) | ≤0.79 ng TEQ/kg wet weight | BPJ |

*RBP II analysis may be considered for assessment decision on a case-by-case basis, **For identification of impairment, one or more of the following variables may be used to identify possible causes/sources of impairment: NPDES facility compliance with whole effluent toxicity test and other limits, turbidity and suspended solids data, nutrient (nitrogen and phosphorus) data for water column/sediments.

¹Maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion. ² Saltwater is temperature dependent only. ³ The minimum quantification level for TRC is 0.05 mg/L. ⁴For the purpose of this report, the S-EL for total polychlorinated biphenyl compounds (PCB) in sediment (which varies with Total Organic Carbon (TOC) content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

Note: National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500µg/kg wet weight (ppb, not lipid-normalized). PCB data (tissue) in this report are presented in µg/kg wet weight (ppb) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

FISH CONSUMPTION USE

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment (MDPH 2002c). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species pose a health risk for human consumption. Hence, the Fish Consumption Use is assessed as non-support in these waters.

In July 2001, MDPH issued new consumer advisories on fish consumption and mercury contamination (MDPH 2001a).

1. The MDPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001a)."
2. Additionally, MDPH "...is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001a)."

Other statewide advisories that MDPH has previously issued and are still in effect are as follows (MDPH 2001a):

1. Due to concerns about chemical contamination, primarily from polychlorinated biphenyl compounds (PCBs) and other contaminants, no individual should consume lobster tomalley from any source. Lobster tomalley is the soft green substance found in the tail and body section of the lobster.
2. Pregnant and breastfeeding women and those who are considering becoming pregnant should not eat bluefish due to concerns about PCB contamination in this species.

The following is an overview of EPA's guidance used to assess the status (support or impaired) of the *Fish Consumption Use*. Because of the statewide advisory no waters can be assessed as support for the *Fish Consumption Use*. Therefore, if no site-specific advisory is in place, the *Fish Consumption Use* is not assessed.

| Variable | Support No restrictions or bans in effect | Impaired There is a "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species or there is a commercial fishing ban in effect |
|--|--|---|
| MDPH Fish Consumption Advisory List (MDPH 2001a, MDPH 2002c) | Not applicable, precluded by statewide advisory (mercury and/or PCB) | Waterbody on MDPH Fish Consumption Advisory List |

Note: MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

DRINKING WATER USE

The term *Drinking Water Use* denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters in 314 CMR 4.04(3). MA DEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act (SDWA). Except for suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) all public drinking water supplies are monitored as finished water (tap water). Monitoring includes the major categories of contaminants established in the SDWA: bacteria, volatile and synthetic organic compounds, inorganic compounds and radionuclides. The DWP maintains current drinking supply monitoring data. The status of the supplies is currently reported to MA DEP and EPA by the suppliers on an annual basis in the form of a consumer confidence report (<http://yosemite.epa.gov/oqwdw/ccr.nsf/Massachusetts>). Below is EPA's guidance to assess the status (support or impaired) of the drinking water use.

| Variable | Support | Impaired |
|---|--|--|
| | No closures or advisories (no contaminants with confirmed exceedances of maximum contaminant levels, conventional treatment is adequate to maintain the supply). | Has one or more advisories or more than conventional treatment is required or has a contamination-based closure of the water supply. |
| Drinking Water Program (DWP) Evaluation | See note below | See note below |

Note: While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at <http://www.state.ma.us/dep/brp/dws/dwshome.htm> and from the Buzzard's Bay Watershed's public water suppliers.

SHELLFISH HARVESTING USE

This use is assessed using information from the Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Marine Fisheries (DMF). A designated shellfish growing area is an area of potential shellfish habitat. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units and they range from being approved to prohibited (described below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed*. Not enough testing has been done in these areas to determine whether or not they are fit for shellfish harvest, therefore, they are closed for the harvest of shellfish.

| Variable | Support | Impaired |
|---|---|---|
| | SA Waters: Approved ¹ SB Waters: Approved ¹ , Conditionally Approved ² or Restricted ³ | SA Waters: Conditionally Approved ² , Restricted ³ , Conditionally Restricted ⁴ , or Prohibited ⁵ SB Waters: Conditionally Restricted ⁴ or Prohibited ⁵ |
| DMF Shellfish Project Classification Area Information (DFWELE 2000) | Reported by DMF | Reported by DMF |

NOTE: Designated shellfish growing areas may be viewed using the MassGIS datalayer available from MassGIS at <http://www.state.ma.us/mgis/dsga.htm>. This coverage currently reflects classification areas as of July 1, 2000.

¹ **Approved** - "...open for harvest of shellfish for direct human consumption subject to local rules and regulations..."

An approved area is open all the time and closes only due to hurricanes or other major coastwide events.

² **Conditionally Approved** - "...subject to intermittent microbiological pollution..." During the time the area is open, it is "...for harvest of shellfish for direct human consumption subject to local rules and regulations..." A conditionally approved area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, shellfish harvested are treated as from an approved area.

³ **Restricted** - area contains a "limited degree of pollution." It is open for "harvest of shellfish with depuration subject to local rules and state regulations" or for the relay of shellfish. A restricted area is used by DMF for the relay of shellfish to a less contaminated area.

⁴ **Conditionally Restricted** - "...subject to intermittent microbiological pollution..." During the time area is restricted, it is only open for "the harvest of shellfish with depuration subject to local rules and state regulations." A conditionally restricted area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, only soft-shell clams may be harvested by specially licensed diggers (Master/Subordinate Diggers) and transported to the DMF Shellfish Purification Plant for depuration (purification).

⁵ **Prohibited** - Closed for harvest of shellfish.

PRIMARY CONTACT RECREATION USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water during the primary contact recreation season (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support or impaired) of the *Primary Contact Recreation Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

| Variable | Support Criteria are met, no aesthetic conditions that preclude the use | Impaired Frequent or prolonged violations of criteria and/or formal bathing area closures, or severe aesthetic conditions that preclude the use |
|---|---|--|
| Bacteria (MDPH 2002a) Minimum Standards for Bathing Beaches State Sanitary Code and MA DEP 1996a | At "public bathing beach" areas: Formal beach postings/advisories neither frequent nor prolonged during the swimming season (the number of days posted or closed cannot exceed 10% during the locally operated swimming season). Other waters: Samples* collected during the primary contact season must meet criteria (Table 1). Shellfish Growing Area classified as "Approved" by DMF. | At "public bathing beach" areas: Formal beach closures/postings >10% of time during swimming season (the number of days posted or closed exceeds 10% during the locally operated swimming season). Other waters: Samples* collected during the primary contact season do not meet the criteria (Table 1). |
| Aesthetics (MA DEP 1996a) - All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance [growth or amount] species of aquatic life | | |
| Odor, oil and grease, color and turbidity, floating matter | Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ. | Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ. |
| Transparency (MDPH 1969) | Public bathing beach and lakes – Secchi disk depth ≥ 1.2 meters ($\geq 4'$) (minimum of three samples representing critical period*). | Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period*). |
| Nuisance organisms | No overabundant growths (i.e., blooms or dense/very dense biovolume of non-native macrophytes) that render the water aesthetically objectionable or unusable*, BPJ. | Overabundant growths (i.e., blooms or dense/very dense biovolume of non-native macrophytes) rendering the water aesthetically objectionable and/or unusable*, BPJ. |

* Data sets to be evaluated for assessment purposes must be representative of a sampling location (minimum of five samples per station recommended) over the course of the primary contact season. Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use. An impairment decision will not be based on a single sample (i.e., the geometric mean of five samples is <200 cfu/100mL but one of the five samples exceeds 400 cfu/100mL). The method detection limit (MDL) will be used in the calculation of the geometric mean when data are reported as less than the MDL (e.g. use 20 cfu/100mL if the result is reported as <20 cfu/100mL). Those data reported as too numerous to count (TNTC) will not be used in the geometric mean calculation, however, frequency of TNTC sample results should be presented.

SECONDARY CONTACT RECREATIONAL USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support or impaired) of the *Secondary Contact Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

| Variable | Support Criteria are met, no aesthetic conditions that preclude the use | Impaired Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use |
|---|---|--|
| Fecal Coliform Bacteria (MA DEP 1996a) | Other waters: Samples* collected must meet the Class C or SC criteria (see Table 1). | Other waters: Samples* collected do not meet the Class C or SC criteria (see Table 1). |
| <i>Aesthetics (MA DEP 1996a) - All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance [growth or amount] species of aquatic life</i> | | |
| Odor, oil and grease, color and turbidity, floating matter | Narrative "free from" criteria met or excursions neither frequent nor prolonged*, BPJ. | Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged*, BPJ. |
| Nuisance organisms | No overabundant growths (i.e., blooms or dense/very dense biovolume of non-native macrophytes) that render the water aesthetically objectionable or unusable*, BPJ. | Overabundant growths (i.e., blooms or dense/very dense biovolume of non-native macrophytes) rendering the water aesthetically objectionable and/or unusable*, BPJ. |

*Data sets to be evaluated for assessment purposes must be representative of a sampling location (minimum of five samples per station recommended) over time. Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use.

AESTHETICS USE

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support or impaired) of the *Aesthetics Use*.

| Variable | Support Narrative "free from" criteria met | Impaired Objectionable conditions frequent and/or prolonged |
|--|--|---|
| Aesthetics (MA DEP 1996a) Visual observations | Narrative "free from" criteria met, BPJ ($\leq 10\%$ extent of spatial and temporal degradation). | Narrative "free from" criteria not met, BPJ ($> 10\%$ extent of spatial and temporal degradation). |

BUZZARDS BAY WATERSHED DESCRIPTION

The National Estuary Program (NEP) was established in 1987 by amendments to the Clean Water Act to identify, restore, and protect nationally significant estuaries of the United States. The Buzzards Bay Project (BBP, <http://www.buzzardsbay.org>), established in 1985 and accepted into the NEP in 1987, is one of 28 National Estuary Programs in the United States. The mission of the BBP, a unit of the Massachusetts Office of Coastal Zone Management, is "to provide technical assistance and funding to municipalities surrounding the Bay to facilitate implementation of the recommendations in the Buzzards Bay Comprehensive Conservation Management Plan (CCMP)." The following basin description was adapted from the CCMP (BBP August 1991).

"Buzzards Bay is a moderately large estuary located between the westernmost part of Cape Cod, southeastern Massachusetts, and the Elizabeth Islands (Figure 8). The Bay is 28 miles long, averages about 8 miles in width, and has a mean depth of 36 feet. It is approximately 228 square miles in size. The coastline stretches over 280 miles and includes 11 miles of public beaches."

The Buzzards Bay drainage basin covers 432 square miles and includes all or sections of 17 municipalities in Massachusetts and Rhode Island. The Bay itself is part of an interconnected hydrologic system that includes several rivers. The largest river basins along the western shore include the Agawam, Wankinco, Weweantic, Mattapoissett, Acushnet, Paskamanset, and Westport. The prominent freshwater streams along the eastern shore are the Back, Pocasset, and Wild Harbor Rivers and Herring Brook. Groundwater seepage is also part of the inflow to Buzzards Bay. "In general, rivers within the drainage basin are slow-moving, meandering streams near their headwaters and for most of their freshwater length. Nearing the coast, the action of the tides rapidly widens the channels as the transition occurs from freshwater stream to tidal estuary. On average, Buzzards Bay rivers are considerably shorter (usually much less than 20 miles) and have smaller drainage areas than other rivers within the state."

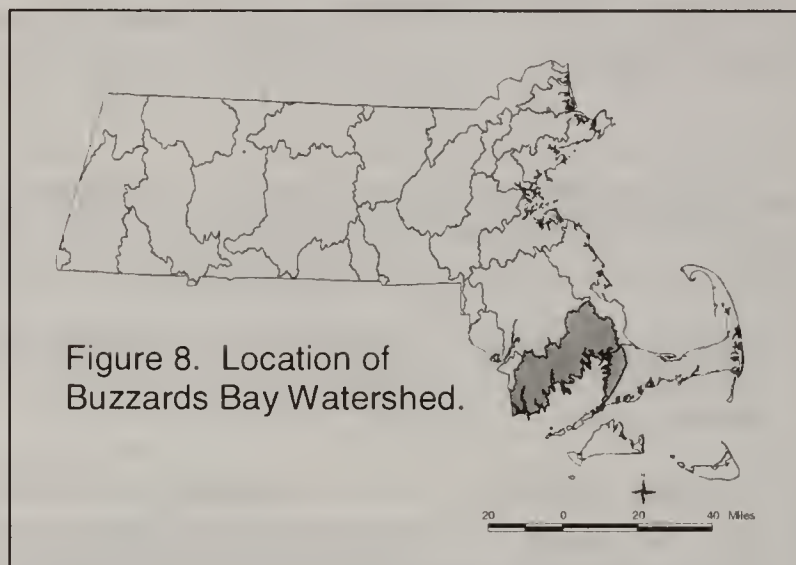


Figure 8. Location of Buzzards Bay Watershed.

Today, approximately 373,690 people live in the watershed with approximately 40% residing in the Greater New Bedford area (CBB Undated a).

Physical Features of the Bay

The Bay was formed during the last ice age approximately 15,000 years ago. Before that Buzzards Bay was periodically submerged as glaciers advanced and retreated through the region, causing sea levels to rise and fall. The southeastern side of the Bay (Bourne, Falmouth, and the Elizabeth Islands) consists of glacial debris deposited by the glacier's leading edge. Consequently, it has a relatively smooth shoreline composed mostly of sand and gravel particles. The northwestern side (Wareham to Westport), with its numerous elongated bays and inlets, was formed by the glacier's retreat to the north. Many of these bays and inlets have since become sheltered from the ocean through the formation of barrier spits.

The distribution and stability of a bay environment depends on three primary physical characteristics of the water: circulation, salinity, and temperature. Tidal currents and wind are the dominant circulation forces in Buzzards Bay because the Elizabeth Islands protect the Bay from large, long-period, open-ocean waves. Complete tidal mixing of Bay water with ocean water is estimated to occur every 10 days.

Water temperatures in the Bay range from a summer maximum of 71.6° F (22° C) to 28°F (-3° C) in winter. During colder winters, the upper reaches of the Bay often freeze, whereas during the spring and summer, solar warming keeps surface waters warmer than the deeper waters. The shallowness of the Bay, combined with surface wave mixing and turbulent tidal flow, prevents strong thermal stratification, so that the Bay is well mixed through most of the year.

Salinity has a small annual range and gradually increases offshore. There are few large streams bringing fresh water into the Bay, with the result that salinity offshore is essentially the same as that of other embayments, such as Block Island and Vineyard Sounds, which receive relatively little fresh water. In the semienclosed embayments along shore, salinity is more variable. Overall, the Bay is a tidally dominated, well-mixed estuarine system.

Land Use Within the Bay

In 1984, much of Buzzards Bay remained undeveloped, with slightly over 60% of the land classified as forest and 14% of the land classified in the residential/commercial/industrial categories. Much of the forested land is away from the coast. When land use within a half mile of the coast is examined, only 40% is forested, and more than 30% is in the residential/industrial/commercial categories. Within specific embayment drainage basins, there is considerable variation as well.

Based on the latest land use figures (MassGIS 2002), the residential, commercial, and industrial uses account for about 12% of the watershed, and approximately 79% of the watershed is undeveloped forest, agriculture or wetland areas. Yet only 10% of the total land area is protected open space. Still, the CCMP statement of 1991 remains true today ... *"The large amount of undeveloped land highlights the importance of wise land-use planning to protect Buzzards Bay."*

There are two Areas of Critical Environmental Concern (ACECs) in the Buzzards Bay Watershed, the Back River and Pocasset River, both of which are located entirely within the town of Bourne. The Bourne Back River ACEC was officially designated on 24 April 1989 and lies south of the Cape Cod Canal. This ACEC encompasses 1,850 acres (2.89 mi²) and contains unaltered and undeveloped salt marshes, tidal flats, and freshwater wetlands. The Back River contains at least three known state-listed rare and endangered species, including osprey, spotted turtle, and diamondback terrapin. The area is used extensively by recreational and educational groups, including the local school system, the Northeast Marine Environmental Institute, and the Woods Hole research community.

The 150-acre (0.23 mi²) Pocasset River ACEC, located on the eastern shore of Buzzards Bay, was officially designated on 5 December 1980. This ACEC runs from the Shore Road Bridge to the headwaters of the Pocasset River and is a relatively undeveloped, important wildlife habitat. The freshwater ponds within this ACEC were originally used by an iron foundry and are spring fed, remaining ice-free in winter and serving as important seasonal habitat for bird species. The ponds support recreational fishing, while the town's most productive oyster crop is found in the more saline waters of the estuary. A comprehensive ecological inventory of the lower portions has been conducted and a new species of crustacean was first discovered in the river (MA DEM March 2003).

CLASSIFICATION

Consistent with the National Goal Uses of "fishable and swimmable waters", the waters in the Buzzards Bay Watershed are classified in accordance with the SWQS in the following manner (MA DEP 1996a).

"Class A – These waters are designated as a source of public water supply. To the extent compatible with its use they shall be an excellent habitat for fish, other aquatic life and wildlife, and suitable for primary and secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORW) under 314 CMR 4.04(3)" (Rojko *et al.* 1995).

- Copicut Reservoir, Source to outlet in Fall River and Dartmouth and those tributaries thereto (PWS)
- Sand Pond, Source to outlet in Wareham and those tributaries thereto (PWS)

"Class SA – These waters are designated as an excellent habitat for fish, other aquatic life and wildlife and for primary and secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value."

- Buttermilk Bay
- Onset Bay
- Wareham River, Entire Length
- Horseshoe Pond to confluence
- Sippican River, County Road to confluence
- Sippican Harbor
- Aucoot Cove
- Mattapoissett Harbor
- Nasketucket Bay
- Outer New Bedford Harbor
- Clark Cove, New Bedford-Dartmouth (CSO)
- Apponagansett Bay, Dartmouth
- Slocums River
- Wesport River, West Branch, Entire Length
- Pocasset River (ORW)

"Class B – These waters are designated as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value."

- Agawam River, Source to Wareham STP
- Wewantic River, Source to Outlet of Horseshoe Pond
- Sippican River, Source to County Road, Marion, Wareham
- New Bedford Reservoir, Source to Outlet
- Acushnet Reservoir, Outlet of New Bedford Reservoir
- Westport River, East Branch, Outlet Noquochoke Lake to Old County Road, Westport

"Class SB – These waters are designated as habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value."

- Agawam River, From Wareham STP to confluence
- Acushnet River, Main Street to Rte 6 (CSO)
- Acushnet River, Inlet New Bedford Harbor (CSO)
- Westport River, East Branch, from Old Colony Road to confluence
- Cape Cod Canal, Bourne
- Cape Cod Canal, Sandwich

CSO-impacted Segments - A Combined Sewer Overflow (CSO) is any intermittent overflow, bypass, or other discharge from a municipal combined sewer/storm water system which results from a wet weather flow in excess of dry weather carrying capacity of the system. CSO designated segments are identified as being impacted by the discharge of combined sewer overflows. Overflows may be allowed by the permitting authority without a variance or partial use designation provided that:

- a. an approved facilities plan under 310 CMR 41.25 provides justification for the overflows;
- b. the Division finds through a use attainability analysis, and EPA concurs, that achieving a greater level of CSO control is not feasible for one of the reasons specified at 314 CMR 4.03(4);
- c. existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected; and
- d. public notice is provided through procedures for permit issuance or facility planning under M.G.L. c. 21 §§ 26 through 53 and regulations promulgated pursuant to M.G.L. c. 30A. In addition, the Division will publish a notice in the *Environmental Monitor*.

Other combined sewer overflows may be eligible for a variance granted through permit issuance procedures. When a variance is not appropriate, partial use may be designated for a segment after public notice and opportunity for a public hearing in accordance with M.G.L. c. 30A.

A CSO-impacted segment can be reclassified to B/SB (CSO), B (partial), C, or a CSO Variance can be issued only where a CSO facilities plan demonstrates that elimination of CSOs is not feasible. In those instances, the highest feasible level of CSO control must be implemented and the receiving water may be reclassified accordingly. The technical and cost information included in the CSO facilities plan forms the basis of these determinations and must support a Use Attainability Analysis where a downgrade to B (CSO), B (partial), or C is being considered. A Use Attainability Analysis is a scientific assessment of the technical and economic factors affecting attainment of a use that is conducted by the state and that supports removal of a National Goal Use based on criteria such as costs and impacts associated with attaining that use. [NOTE: A B (CSO) designation only allows for "exceedances" of the B standard for CSO discharges and does not allow for other discharges to exceed the B standard.] A CSO Variance may be issued to allow continued discharge of CSOs while additional data and information are developed to make a final determination on the appropriate water quality standard and level of CSO control (Brander 2002).

Outstanding Resource Water (ORW) designation applies to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools; all designated Class A Public Water Supplies; and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern (ACEC) and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area.

Unlisted waters in Buzzards Bay Watershed not otherwise designated in the SWQS are designated *Class B, High Quality Waters* for inland waters and Class SA, High Quality Waters for coastal and marine waters. According to the SWQS, where fisheries designations are necessary, they shall be made on a case-by-case basis.

"Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. Vernal pool habitat is extremely important to a variety of wildlife species including some amphibians that breed exclusively in vernal pools, and other organisms, such as fairy shrimp, which spend their entire life cycles confined to vernal pool habitat. Many additional wildlife species utilize vernal pools for breeding, feeding and other important functions. Certified vernal pools are protected if they fall under the jurisdiction of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00). Certified vernal pools are also afforded protection under the state Water Quality Certification regulations (401 Program), the state Title 5 regulations, and the Forest Cutting Practices Act regulations. However, the certification of a pool only establishes that it functions biologically as a vernal pool. Certification does not determine that the pool is within a resource area protected by the Wetlands Protection Act (NHESP 1999)." Increased vernal pool certification was a long-term priority of the EOEA's Buzzards Bay Watershed Team. Since the team's focus in 2001, certification data has been collected for more than 70 additional vernal pools in the towns of Dartmouth and Rochester. This is nearly a 300% increase over the two-dozen vernal pools previously certified. Currently 64 vernal pools (Harding 2003) have received full certification. These are located in the towns of Plymouth, Carver, Rochester, Mattapoisett, New Bedford, Fall River, Dartmouth, and Westport. Species of special concern observed in these pools include the spotted turtle (*Clemmys guttata*), the Mystic Valley Amphipod (*Crangonyx aberrans*), and the four-toed salamander (*Hemidactylium scotatum*). Other obligate vernal pool species observed include the spotted salamander (*Ambystoma maculatum*), marble salamanders, unidentified mole salamanders, fairy shrimp (Order Anostraca) and the wood frog (*Rana sylvatica*). Numerous facultative species of frogs, newts (a form or lifestage of a salamander), turtles, and a variety of benthic macroinvertebrates were also documented in vernal pools in the Buzzards Bay Watershed (NHESP 2002). Additional information is available from the Natural Heritage and Endangered Species Program Website:
<http://www.state.ma.us/dfwele/dfw/nhESP/nhESP.htm>

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

The Buzzards Bay drainage area has been the subject of several MA DEP water quality studies in the past. A list of these studies is available in *Publications of the Division of Watershed Management Watershed Planning Program 1963 - 2003* (MA DEP 2003). Early efforts included the 1971 surveys of the Acushnet River and New Bedford Harbor, a 1975 water quality survey of the western shore of Buzzards Bay from the Massachusetts/Rhode Island boundary to Buttermilk Bay, and a 1976 water quality survey of Cape Cod, which included stations on the eastern shore of the Bay in Bourne and Falmouth. In 1985 and 1986 the Massachusetts Division of Water Pollution Control carried out a comprehensive water quality monitoring program by dividing the entire Buzzards Bay drainage into five individual study areas. These surveys represent the last attempt by the MA DEP to perform extensive, area-wide, water quality surveys in Buzzards Bay. At that same time, MA DEP used a number of different bacterial indicators to evaluate nonpoint sources of fecal contamination, and a special cranberry bog input study was performed. Finally, in 1987 and 1988, a caged-mussel biomonitoring pilot study was undertaken at three sites in the vicinity of Clark's Cove, New Bedford. Since that time, MA DEP monitoring efforts have focused primarily on individual problem areas. For example, fish toxics monitoring was performed in selected waterbodies potentially affected by landfills or waste sites.

To address water quality impairments across the entire Buzzards Bay watershed, the EPA designated Buzzards Bay a No Discharge Area (NDA) for boat sewage in August 2001. Encompassing 210 square miles in 11 coastal communities, Buzzards Bay is the largest No Discharge Area in Massachusetts. A No Discharge Area is a designated body of water in which the discharge of all boat sewage, even if it is treated, is prohibited. With 13,000 boats registered in the Buzzards Bay area and with a well-established transient fleet visiting each year, thousands of gallons of raw or partially treated sewage are prevented from entering Buzzards Bay. Untreated or partially treated sewage, such as that from boat heads, contains high concentrations of nitrogen and bacteria. In fact, many marine sanitation devices discharge "treated" waste with bacteria counts five to 70 times higher than that allowable for shellfishing or swimming waters. None of the devices available today are designed to reduce the nitrogen concentration in "treated" wastes. Nitrogen can be a problem in poorly flushed embayments because it stimulates harmful algal growth and contributes to reductions in dissolved oxygen. Both of these conditions can decrease the survivorship and reproductive potential of marine life. Boaters can use any of the 37 pumpout or dump facilities located throughout the Buzzards Bay Watershed to dispose of their sewage.

Cranberries have been grown in southeastern Massachusetts for almost 100 years. Operations associated with cranberry bogs, particularly fertilization practices, may be detrimental to surface water quality. In 2001, the University of Massachusetts Cranberry Experiment Station was awarded a s. 319 grant (Project 01-12/319, Appendix D) to study the phosphorus dynamics in six cranberry bogs. The project is expected to be completed in 2004.

Buzzards Bay was selected by CZM in 2000 as a pilot study area for the use of *bilge socks*, another water quality tool offered to boaters. By soaking up and bonding to oil and gas that get into the bilge, bilge socks help boaters prevent the release of petroleum products to coastal waters. Bilge socks were distributed free of charge through the local harbormasters.

Past water quality surveys in the Buzzards Bay drainage area have documented a number of site-specific sources of pollution, depending upon the individual subwatersheds in question. For example, New Bedford Harbor and the lower Acushnet River watershed is the most urbanized area of the Buzzards Bay drainage. These waterbodies have a history of contamination from municipal and industrial wastewater treatment facilities, combined sewer overflows (CSO), and urban runoff. Sediments in the Acushnet estuary and New Bedford inner and outer harbors have been severely contaminated by PCBs and, as a result, are a designated EPA Superfund site.

The Agawam River exhibits excessive growth of algae and aquatic macrophytes. These result from nutrient inputs from both the Wareham Waste Water Treatment Plant (WWTP) as well as upstream nonpoint sources. Other rural subwatersheds around Buzzards Bay are also affected by nonpoint sources, such as agricultural runoff.

There are five EPA designated Superfund sites in the watershed: Atlas Tack in Fairhaven; Re-Solve, Inc. in Dartmouth; Sullivan's Ledge in New Bedford; Massachusetts Military Reservation; and New Bedford Harbor. The water quality implications of each are described below.

The **Atlas Tack Corporation** formerly manufactured cut and wire tacks, steel nails, and similar items on a 24-acre site in Fairhaven located in the Outer New Bedford Harbor subwatershed (Segment MA95-63). From the 1940s until the late 1970s wastes containing cyanide and heavy metals, including high levels of arsenic, were discharged into an unlined acid neutralizing lagoon located approximately 200 feet east of the manufacturing building and adjacent to a saltwater tidal marsh in the Buzzards Bay Estuary. Other contaminated areas at the site include a filled wetland, former dump, and other chemical spills. The area is residential and commercial. Approximately 7,200 people live within a 1-mile radius and approximately 15,150 people live within 3 miles of the site. The groundwater is contaminated with cyanide and toluene that has leached from the site lagoons. The on-site soil is contaminated with volatile organic compounds (VOCs), including toluene and ethyl benzene; heavy metals, including chromium, cadmium, lead, and nickel; pesticides; polychlorinated biphenyls (PCBs); and polycyclic aromatic hydrocarbons (PAHs). The marsh south of the lagoon and estuarine areas in Buzzards Bay are also contaminated causing an ecologic risk to the wildlife. The Remedial Action (cleanup activities) is awaiting funding of \$13.1 million for this fiscal year (FY04). The Remedial Action will be performed in three phases: Phase I - demolition of the manufacturing and power plant buildings; Phase II - excavation of contaminated soils and debris from the commercial and debris and fill areas; and, Phase III - excavation of marsh soils and creek bed sediments. The Remedial Design has been completed for Phase I and II. As part of the design for Phase III, EPA recently performed a bioavailability study of the contaminated marsh area on the site. Results of the study will allow EPA to determine the nature and extent of toxicity present to the ecological community by way of uptaking available contaminants and will more clearly define the limits of excavation in the marsh. All contaminated materials, estimated at 54,000 cubic yards, will be shipped off-site to licensed landfills. Site restoration of each area will follow excavation and after confirmatory soil sample analysis shows that the cleanup levels have been met. (EPA 13 December 2002a).

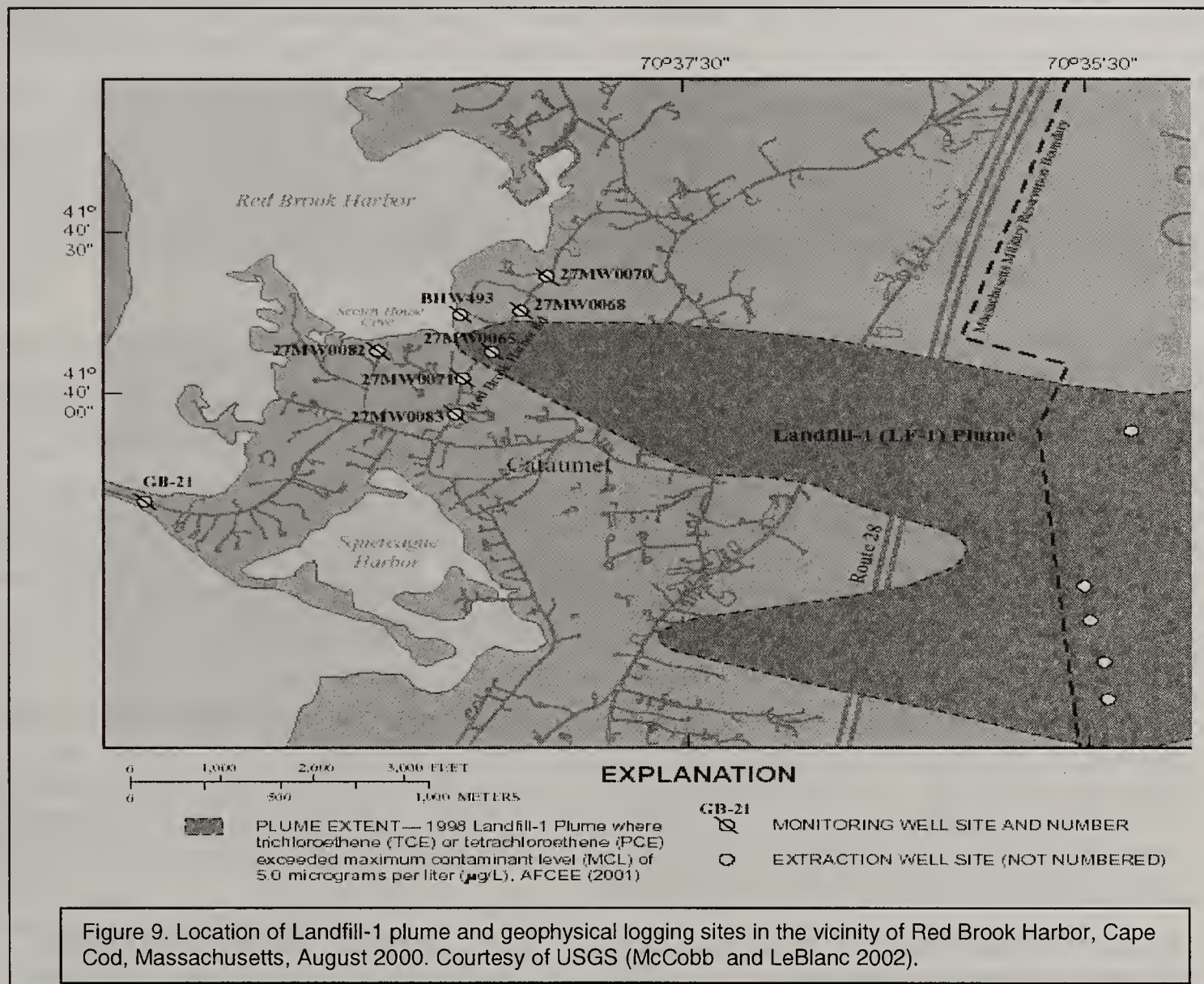
The **Re-Solve, Inc. Superfund Site** is a former waste chemical reclamation facility situated on 6 acres of land in Dartmouth in the Copicut River subwatershed (Segment MA95-43). Between 1956 and 1980, Re-Solve handled a variety of hazardous materials, including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids, and polychlorinated biphenyls (PCBs). Residues from the distillation tower, liquid sludge waste, impure solvents, and burned tires were disposed of in four on-site unlined lagoons. The lagoon contents were burned periodically to reduce the VOC content. An oil waste that accumulated at the bottom of the degreaser distillation still was disposed of on one portion of the site through landfarming. This oil waste also was spread throughout the site to control dust. Cooling water from the distillation tower was discharged to a shallow on-site lagoon. In 1974, the State issued Re-Solve a license to collect and dispose of hazardous waste. In 1980, the State agreed to accept Re-Solve's offer to surrender its disposal license on the condition that all hazardous waste be removed from the site. In 1981, legal action resulted in all drums, debris, and buildings being removed, but the contents of the four lagoons remained. Approximately 300 people live within a 1-mile radius of the site. Three residences are located within 150 yards of Re-Solve. The site is bounded by wetlands to the north, east, and southeast, and the land surrounding the site is predominantly zoned for single-family residential use. The bottoms of the lagoons are situated in the water table and some contaminants have migrated to groundwater and sediments. All residences obtain their water from private wells located on their property. Groundwater is contaminated with VOCs and PCBs. Sediments are contaminated with PCBs and VOCs. Soil contains PCBs, lead, and VOCs including, trichloroethylene (TCE), vinyl chloride, methylene chloride, and toluene. Surface water is contaminated with PCBs and VOCs. Fish from the adjacent Copicut River and Cornell Pond contain elevated levels of PCBs and mercury (mercury is not related to the site). The Copicut River, located about 500 feet from the site, has been designated for the protection and propagation of fish, other aquatic life, and wildlife. The site is located over an aquifer that serves as a local drinking water source for private residential wells and serves as a recharge area for part of a nearby town where a new municipal well is being planned. Contaminants are moving off site in surface water runoff and groundwater. Monitoring of the system will continue for treated water effluent, treated air effluent, and surrounding groundwater, surface water and wetlands. In addition, annual monitoring of selected residential wells surrounding the site and fish from Copicut River and Cornell Pond will continue. Since 1998, EPA has hosted an annual fishing derby at Cornell Pond to ensure appropriate fish species were collected under

the site's environmental monitoring program. The fishing derbies have been held in September or October, to tap into the experience of local fishermen for collecting fish from the pond. The derbies actively and safely involve the community in an important fish monitoring program and provide EPA with an opportunity to re-emphasize the Massachusetts Department of Public Health Fish Advisory not to consume American Eel and limit consumption of other fish species caught from the pond or river. Public recreational fishing (catch and release) is permitted at the pond and river. At the conclusion of the derbies, awards were issued to each fisherman catching the largest fish species. The fishing derbies have been an overwhelming success and the community looks forward to the event every year. In 1999, the potentially responsible parties, with EPA and U.S. Fish and Wildlife Service oversight, implemented a voluntary ecological beneficial re-use program at the site. The parties designed and installed a 4-acre native upland meadow cover which replaced the existing gravel cover at the site. This restoration and beneficial ecological re-use was intended to re-establish native species at the site and enhance environmental habitat (EPA 13 December 2002b).

The 12-acre **Sullivan's Ledge** disposal area, in the northwestern corner of New Bedford (Paskamansett River subwatershed -Segment MA95-11), operated as a quarry until about 1932. In 1935, the City of New Bedford acquired the site through tax title foreclosure. Between the 1940s and the 1970s, local industries used the quarry pits and adjacent areas for disposal of hazardous material and other wastes including electrical capacitors, fuel oil, volatile liquids, tires, scrap rubber, demolition materials, brush and trees.

Approximately 98,500 people live within 3 miles of the site in this residential area. An unnamed stream borders the site and discharges into Middle Marsh, which is on the golf course. Immediately north of the marsh lie railroad tracks, the Apponagansett Swamp, and the City of New Bedford municipal landfill. Volatile organic compounds in the on-site and immediately off-site groundwater increase with depth. Inorganic compounds and PCBs also are present in the groundwater. The soil is contaminated with PCBs and PAHs. The soils along the eastern and southern boundaries contained the highest contaminant concentrations. Soils have eroded from the site into the unnamed stream and have been transported from the site. Sediments in the unnamed stream, Middle Marsh, four golf course water hazards, and a portion of the Apponagansett Swamp were contaminated with PCBs. The quarry area was capped to reduce potential exposures. Likewise, the unnamed stream, Middle Marsh, and water hazards have been cleaned and the resulting materials buried within the on-site cap. The EPA chose the following remedies for cleaning up the disposal area portion of the site: excavate and dispose of sediments from the stream and the golf course water hazards; construct an impermeable cap over an 11-acre area to cover the quarry pits and contain the contaminated surface soils and sediments that would be placed on site; divert and line a portion of the unnamed stream to prevent water from being pulled into extraction wells; install an active pumping system to collect contaminated shallow bedrock groundwater, a passive collection system to collect contaminated seeps and shallow groundwater, and a treatment system to treat collected groundwater; restore and enhance the wetlands to reasonably similar hydrologic and botanical conditions that existed prior to excavation; monitor the site with 5-year reviews; and use institutional controls to ensure that the bedrock groundwater will not be used for drinking water since it cannot be cleaned to drinking water standards. The groundwater treatment plant began operating in late 1999. Construction on the cap began in the spring of 1998 and was completed in 2000. In 1989, the EPA began a study of the contamination in the Middle Marsh sediments. In 1991, the EPA released results of the studies, which indicated significant PCB accumulation in wildlife in and around Middle Marsh. While sediments in the Marsh also were found to be heavily contaminated with PCBs, the threat to human health was judged to be negligible. A decision on the appropriate cleanup remedy was reached in late 1991. The EPA chose the following remedy for Middle Marsh: establish security measures and clear the land, excavate contaminated sediments from portions of the Middle Marsh and the adjacent wetland, screen and dewater the excavated sediments, dispose of the excavated materials beneath the cap to be constructed at the Sullivan's Ledge Disposal Area, restore the affected wetlands, use institutional controls to prevent future residential use of and restrict access to the area, and establish a long-term environmental monitoring plan. In the event that the Sullivan's Ledge Disposal Area would be unavailable for disposal, the EPA also selected a contingency remedy that includes the same site preparation, excavation, wetlands restoration, institutional controls and long-term monitoring as the remedy described above. However, excavated sediments would be treated by solvent extraction and replaced within Middle Marsh. Initial construction activities began in 1999 and were completed during 2000 (EPA 13 December 2002c).

The Otis Air National Guard Base/Camp Edwards site covers approximately 22,000 acres (Figure 9) and is commonly known as the **Massachusetts Military Reservation (MMR)**. Although the occupants and property boundaries have changed several times since MMR was established in 1935, the primary mission has always been to provide training and housing to Air Force and Army units. The EPA has designated the Sagamore Lens underlying MMR as a sole source aquifer under the Safe Drinking Water



Act. A review of past and present operations and waste disposal practices identified numerous potentially contaminated areas causing the EPA to designate MMR a Superfund site. The Air Force Center for Environmental Excellence (AFCEE) is the lead agency in the cleanup of seven groundwater plumes emanating from the MMR. These contaminated areas are the result of historic chemical/fuel spills, fire training activities, landfills, drainage structures and effluent from the former sewage treatment plant. Of particular importance to the Buzzards Bay Watershed is a plume emanating from a former landfill (LF-1) that has contaminated several private wells, two Bourne public water supply wells in Cataumet. The LF-1 plume has two lobes, a northern lobe that has reached the coast at Red Brook Harbor (Segment MA95-18) and a southern lobe heading toward the coast at Squeteague Harbor (Segment MA95-55) (McCobb and LeBlanc 2002). A second plume from the central impact area has impacted the Bourne public water supply wells in Monument Beach. In 1995, the landfill was capped and by 1999, AFCEE began the groundwater extraction and treatment operations along the MMR western boundary between the northern and southern lobes of the LF-1 plume. The system is designed to extract water from those zones within the plume that contain the highest concentrations of contaminants such as tetrachloroethene or perchloroethene (PCE), trichloroethene (TCE), and carbon tetrachloride. It is estimated that the cleanup operation will last another 20-25 years. In 2000, the USGS investigated where freshwater discharges to the harbor and what concentrations of VOCs are in the groundwater as it enters the harbor (McCobb 2001). In 1997 and 2001, the MDPH sampled shellfish in Red Brook and Squeteague Harbors and found that certain VOC's were either not detected or at concentrations below "any available health-based screening value for fish or shellfish" (MDPH 2002d). In June 2002, the AFCEE funded a pipeline linking the Bourne Water District water main to the Upper Cape Water Supply Cooperative supply thereby

making up for the Town's projected drinking water shortfalls. The AFCEE also plans to continue monitoring at Red Brook and Squeteague Harbors as well as at monitoring and extraction wells in and around the LF-1 plume area. Additional information is available at <http://www.mmr.org/Cleanup/index.htm> and <http://water.usgs.gov/pubs/wri/wri024166>.

The 18,000-acre **New Bedford Harbor** Superfund site (Segments MA95-33, 95-39, 95-39, 95-42, 95-62, and 95-63) is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls and heavy metals. At least two manufacturing facilities in the area used PCBs while producing electric devices from 1940 to the late 1970s, when EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result, the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay. Bioaccumulation of PCBs within the marine food chain has resulted in closing the area to lobstering and fishing, and recreational activities and harbor development have been limited by the widespread PCB problem. Over 100,000 people live within 3 miles of the site (EPA 13 February 2003).

Measurements taken in New Bedford Harbor indicate tidal action transports up to 0.5 pounds per day of PCBs from the upper harbor to the lower harbor and, ultimately, Buzzards Bay. This site is being addressed in the following four stages: early action and three long-term remedial phases focusing on the Acushnet River, the upper and lower harbor, and the Buzzards Bay area (EPA 13 February 2003).

Early Action - In May 2001, EPA completed the excavation and restoration of the highly PCB-contaminated shoreline in Acushnet near a residential area and installed temporary fencing at two New Bedford shoreline locations to minimize exposure to contaminated shoreline sediments. According to a 2000 Dredging Study prepared by the EPA and ACOE, final dredging of the approximately 200 acres of PCB-contaminated sediment is currently scheduled to begin in fall 2003.

Acushnet River - A 5-acre northern portion of the Acushnet River Estuary contaminated with high levels of PCBs has been identified as the "hot spot" area of the superfund site. Between April 1994 and September 1995, approximately 14,000 cubic yards of sediment were dredged from the hot spot and temporarily stored in a lined and covered holding pond while the EPA reconsidered permanent storage alternatives. By May 2000 all the dredge spoils were transported to an offsite Toxic Substances Control Act permitted landfill.

Upper and Lower New Bedford Harbor - After an extensive process of studying New Bedford Harbor and developing consensus for a solution to the widespread PCB problem in the Upper and Lower Harbor areas, EPA issued a final ROD in September 1998. The selected remedy calls for dredging and shoreline containment of approximately 450,000 cubic yards of contaminated sediment and wetlands in four combined disposal facilities.

Buzzards Bay Area - The EPA plans to initiate additional investigations of this area of the site (south of the hurricane barrier) to determine if additional cleanup actions are necessary.

EPA investigations identified the Aerovox facility as the primary source of PCBs to New Bedford Harbor. PCB wastes were discharged from Aerovox's operations directly to the upper harbor through open trenches and discharge pipes, or indirectly throughout the site via combined sewer overflows (CSOs) and the City's sewage treatment plant outfall. Secondary inputs of PCBs were also made from the Cornell Dubilier Electronics, Inc. (CDE) facility (EPA 29 July 2003).

Aerovox Incorporated consented to a clean up plan on its property adjacent to the upper harbor. The administrative consent orders issued in 1982 and 1999 required isolation of the contaminated soil, monitoring of the groundwater until 2014, measures to protect employees, relocation to a new facility, implementation of a security plan at the closed facility, establishment of a trust fund with annual deposits, and when \$4.8 million was accumulated in the fund, demolition of the facility and capping the site. The company has relocated to a new facility. However, in June 2001, Aerovox filed a voluntary Chapter 11 bankruptcy petition (EPA 29 July 2003).

Cornell Dubilier Electronics, Inc. (CDE) consented in 1983 to address handling, discharging, and releases of PCB and to monitor the groundwater. CDE also removed and disposed of PCB-contaminated sediments from portions of the municipal sewer system downstream of the CDE plant in the fall of 1984. The City of New Bedford, pursuant to the state's hazardous waste regulations, encased and abandoned approximately one and one-half mile of sewer interceptor that had a build-up of PCB-contaminated grit (EPA 29 July 2003).

In 1991 and 1992, a settlement was reached between the United States National Oceanic and Atmospheric Administration (NOAA), the Commonwealth, and five of the original six defendants which, at various times, owned or operated either of the two capacitor manufacturing facilities along the New Bedford Harbor. The companies (Aerovox Incorporated, Belleville Industries, Inc., AVX Corporation, CDE, Inc., and Federal Pacific Electric Company) agreed to pay damages for injury to natural resources at and near the site caused by releases of PCBs and to repay EPA for the response costs incurred (EPA 29 July 2003).

Other factors influencing water quality in the Buzzards Bay Watershed include mercury contamination, nutrient enrichment, and combined sewer overflows. The northeastern United States has been identified as receiving elevated rates of mercury deposition from the atmosphere and having high levels of mercury contamination in freshwater fishes (Tatsutani 1998). All forms of mercury are toxic to humans and have no known function in any normal biological process. Mercury can be transformed into methylmercury. The ability of methylmercury to bind to proteins (e.g., muscle tissues) contributes to its ability to biologically concentrate into aquatic organisms by factors ranging from 10,000 to 1,000,000 its concentration in water (Stein *et al.* 1996). Aside from point discharges, most of the mercury contamination in the northeastern United States has been linked to air emissions (incineration, fossil fuel combustion, and sewage treatment plant operation), and agricultural practices (herbicides, fungicides) from both local and up-wind sources. The primary vector of mercury exposure in people is through the consumption of contaminated foodstuffs.

In 1994, MDPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MDPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts therefore the *Fish Consumption Use* cannot be assessed as support. In July 2001, MDPH issued a new, more inclusive, fish consumption advisory for both fresh and salt waters in the Commonwealth (MDPH 2001a).

MDPH is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH has expanded its previously issued statewide fish consumption advisory, which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001a)

MDPH has issued site-specific advisories on the following waterbodies in the Buzzards Bay Watershed (MDPH 2002c):

- Copicut River and Cornell Pond (Dartmouth),
- Noquochoke Lake (Dartmouth),
- Turner Pond (Dartmouth/New Bedford),
- Snipituit and Long ponds (Rochester),
- New Bedford Harbor (New Bedford/Fairhaven).

The Coalition for Buzzards Bay Baywatchers conducted weekly monitoring in the 28 major harbors and coves in Buzzards Bay (<http://www.savebuzzardsbay.org/www/research/baywatchers.htm>). The Buzzards Bay Water Quality Monitoring Program was initiated in 1992 to "assess and evaluate nitrogen-related water quality and long-term ecological trends in Buzzards Bay" (Howes *et al.* 1999). Data from this program are collected in support of the Buzzards Bay Health Index, developed by the Coalition to gauge the health of an embayment, and to provide a "bay at a glance picture of conditions" throughout Buzzards

Bay (Howes *et al.* 1999). The index uses oxygen saturation, Secchi disk depth (transparency), phytoplankton pigments (chlorophyll a and phaeophytin), dissolved inorganic nitrogen, and total organic nitrogen (dissolved and particulate) to give a score of 0-100. Additional information is presented in the Coalition's *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* (CBB Undated b).

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The following waterbodies in the Buzzards Bay Watershed appear on the *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* with Good/Excellent water quality (Five Year Average Health Index Scores range between 65-100)

- Fiddlers Cove Onset Harbor
- Shell Point Bay
- Back River
- Buttermilk Bay
- Pocasset River
- Pocasset Harbor, Inner
- New Bedford Harbor, Outer
- Blankenship Cove
- Sippican Harbor, Outer
- Red Brook Harbor, Outer
- Mattapoissett Harbor, Inner
- Cuttyhunk Pond
- Phinney's Harbor
- Onset Bay, Inner
- West Falmouth, Mid-Harbor
- Rands Harbor
- West Falmouth - Harbor Head
- Clarks Cove, Inner
- Quissett Harbor, Inner
- Onset Bay, Outer
- Westport River, Inlet
- Megansett Harbor
- Clarks Cove, Outer
- West Falmouth, Outer Harbor
- Mattapoissett Harbor, Outer
- Pocasset Harbor, Outer
- Hiller's Cove
- Aucoot Cove, Mid-Harbor
- Quissett Harbor, Outer
- Aucoot Cove, Outer
- Penikese Island

The following waterbodies in the Buzzards Bay Watershed appear on the *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* with Fair water quality (Five Year Average Health Index Scores range between 35-65).

- Little River, Inner
- Wareham River, Inner
- Marks Cove
- New Bedford Harbor, Inner
- Little Bay (Nasketucket)
- Cuttyhunk, West End Pond
- Wareham River, Outer
- Wild Harbor River
- West Falmouth, Snug Harbor
- Little Sippewisset Marsh
- Weweantic River, Outer
- Broadmarsh River
- Little River, Outer
- Mattapoissett Harbor, River Mouth
- Slocums River, Outer
- Aucoot Cove, Inner
- Wild Harbor
- Apponagansett Bay, Mid-Harbor
- Westport River, Inner West Branch
- Sippican Harbor, Inner
- Squeteague Harbor
- Onset Bay, East River
- Nasketucket Bay
- Eel Pond, Bourne
- Little Buttermilk Bay
- Apponagansett Bay, Outer
- Westport River, Outer East Branch
- Hen Cove
- Red Brook Harbor, Inner

The following waterbodies in the Buzzards Bay Watershed appear on the *Baywatchers III- A Decade of Monitoring Buzzards Bay Embayments 1992-2001* with Poor/Eutrophic Conditions (Five Year Average Health Index Scores <35).

- Nasketucket River
- Agawam River
- Eel Pond, Mattapoissett
- Westport River, Upper East Branch
- Acushnet River
- Apponagansett Bay, Inner
- Slocums River, Inner
- Westport River, Mid East Branch
- Hammet Cove
- Weweantic River, Inner

The Clean Water Act Section 303(d) requires states to identify those waterbodies that are not meeting standards and prioritize the development of TMDLs for these waterbodies. Table 2 identifies the waterbodies in the Buzzards Bay Watershed on the most recent, EPA approved, 1998 Massachusetts Section 303(d) List Of Waters (MA DEP 1999). Additionally, all freshwaters in Massachusetts are technically (by default) listed as 303(d) waters with mercury as the associated stressor/pollutant due to the 1994 MDPH Interim Freshwater Fish Consumption Advisory. This Interim Freshwater Fish Consumption Advisory was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. MDPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially (MDPH 1994). EPA released guidance on November 19, 2001 for the preparation of an *Integrated List of Waters* that would combine reporting elements of both § 305(b) and § 303(d) of the CWA. The integrated list format allows states to provide the status of all their assessed waters in a single multi-part list. In October of 2002, MA DEP released Massachusetts *Year 2002 Integrated List of Waters - Context and Rationale for Assessing and Reporting the Quality of Massachusetts Surface Waters* and Massachusetts *Year 2002 Integrated List of Waters Part 2 – Proposed Listing of Individual Categories of Waters* for public comment. The list received approval from EPA on 1 October 2003.

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Table 2. 1998 303(d) List of Waters in the Buzzards Bay Watershed

| Waterbody | WBID | Description | Cause of Impairment |
|--------------------------------|---------|---|--|
| Bates Pond | MA95007 | Carver | Noxious Aquatic Plants |
| Buttonwood Park Pond | MA95020 | New Bedford | Noxious Aquatic Plants |
| Cedar Dell Lake | MA95021 | Dartmouth | Noxious Aquatic Plants |
| Cornell Pond | MA95031 | Dartmouth | Priority Organics, Metals |
| Crane Brook Bog Pond | MA95033 | Carver | Noxious Aquatic Plants |
| Federal Pond | MA95055 | Carver | Noxious Aquatic Plants |
| Fuller Street Pond | MA95058 | Carver | Noxious Aquatic Plants |
| Kings Pond | MA95078 | Plymouth | Noxious Aquatic Plants |
| Little Long Pond | MA95089 | Wareham | Noxious Aquatic Plants |
| Little Rocky Pond | MA95091 | Plymouth | Noxious Aquatic Plants |
| Long Duck Pond | MA95097 | Plymouth | Noxious Aquatic Plants |
| Mare Pond | MA95172 | Plymouth | Noxious Aquatic Plants |
| Mill Pond | MA95105 | Wareham | Noxious Aquatic Plants |
| New Bedford Reservoir | MA95110 | Acushnet | Noxious Aquatic Plants |
| New Long Pond | MA95112 | Plymouth | Noxious Aquatic Plants |
| Noquochoke Lake | MA95113 | Dartmouth | Priority Organics, Metals, Noxious Aquatic Plants, Turbidity |
| Noquochoke Lake {South Basin} | MA95170 | Dartmouth | Priority Organics, Metals, Noxious Aquatic Plants, Turbidity |
| Noquochoke Lake {North Basin} | MA95171 | Dartmouth | Priority Organics, Metals, Noxious Aquatic Plants, Turbidity |
| Parker Mills Pond | MA95115 | Wareham | Noxious Aquatic Plants |
| South Meadow Brook Pond | MA95139 | Carver | Noxious Aquatic Plants |
| Southwest Atwood Bog Pond | MA95141 | Carver | Noxious Aquatic Plants |
| Three Cornered Pond | MA95145 | Plymouth | Noxious Aquatic Plants |
| Tihonet Pond | MA95146 | Wareham | Organic enrichment / Low DO |
| Tinkham Pond | MA95148 | Mattapoisett/Acushnet | Noxious Aquatic Plants |
| Turner Pond | MA95151 | New Bedford/Dartmouth | Turbidity |
| White Island Pond {East Basin} | MA95166 | Plymouth | Nutrients, Organic enrichment/Low DO, Noxious Aquatic Plants |
| White Island Pond {West Basin} | MA95173 | Plymouth | Nutrients, Organic enrichment/Low DO, Noxious Aquatic Plants |
| Acushnet River * | MA95-31 | Outlet New Bedford Reservoir to Hamlin Road culvert | Nutrients, Siltation, Organic enrichment/Low DO, Pathogens |
| Acushnet River * | MA95-32 | Hamlin Road to culvert at Main Street | Nutrients, Organic enrichment/Low DO, Pathogens |

* Segments Needing Confirmation for all causes of impairment

Table 2. (Continued). 1998 303(d) List of Waters in the Buzzards Bay Watershed

| Waterbody | WBID | Description | Cause of Impairment |
|----------------------------|---------|---|---|
| Acushnet River | MA95-33 | Outlet Main Street culvert to Coggeshall Street bridge | Priority organics, Metals, Nutrients, Organic enrichment/Low DO, Pathogens |
| Agawam River | MA95-29 | Wareham WWTP to confluence with Wankinco River, Wareham | Nutrients, Other habitat alteration, Pathogens, Noxious Aquatic Plants |
| Apponagansett Bay | MA95-39 | Dartmouth | Priority organics, Pathogens |
| Aucoot Cove | MA95-09 | (No description) | Pathogens |
| Buttermilk Bay | MA95-01 | Bourne/Wareham | Pathogens |
| Buttonwood Brook* | MA95-13 | Headwaters, New Bedford, to Apponagansett Bay, Dartmouth | Pathogens |
| Cape Cod Canal | MA95-14 | (No description) | Pathogens |
| Clark Cove | MA95-38 | (No description) | Priority organics, Pathogens |
| Copicut River | MA95-43 | Outlet of Copicut Reservoir, Dartmouth/Fall River to the inlet of Cornell Pond, Dartmouth | Priority organics, Metals |
| Hiller Cove | MA95-10 | (No description) | Pathogens |
| Little Sippewisset Marsh | MA95-24 | Falmouth | Pathogens |
| Mattapoisset Harbor | MA95-35 | (No description) | Pathogens |
| Mattapoisset River* | MA95-36 | Outlet Snipatuit Pond, Rochester to River Road Bridge, Mattapoisset | Pathogens |
| New Bedford Inner Harbor | MA95-42 | Coggeshall Street Bridge to Hurricane Barrier | Priority Organics, Metals, Nutrients, Organic enrichment/Low DO, Pathogens |
| Onset Bay | MA95-02 | Wareham | Pathogens |
| Outer New Bedford Harbor | MA95-27 | (Buzzards Bay) Waters landward of a line drawn from Ricketson Point to Wilbur Point | Priority organics, Nonpriority organics, Metals, Organic enrichment/Low DO, Pathogens |
| Paskamanset River* | MA95-11 | Outlet Turners Pond Dartmouth/New Bedford to confluence with Slocums River, Dartmouth | Pathogens |
| Phinneys Harbor | MA95-15 | (No description) | Pathogens |
| Pocasset Harbor | MA95-17 | (No description) | Pathogens |
| Quissett Harbor | MA95-25 | Falmouth | Pathogens |
| Red Brook Harbor | MA95-18 | (No description) | Pathogens |
| Sippican River* | MA95-07 | County Road to confluence with Weweantic River, Marion/Wareham | Pathogens |
| Sippican Harbor | MA95-08 | (No description) | Pathogens |
| Slocums River | MA95-34 | Rock O'Dundee Road to mouth at Buzzards Bay, Dartmouth | Pathogens |
| Snell Creek | MA95-45 | Drift Road to confluence with East Branch Westport River | Pathogens |
| Wareham River | MA95-03 | Route 6 bridge to mouth at Buzzards Bay | Pathogens |
| West Falmouth Harbor | MA95-22 | Falmouth | Pathogens |
| East Branch Westport River | MA95-40 | Outlet Lake Noquochoke to Old County Road bridge | Pathogens |
| Weweantic River* | MA95-04 | Route 28 Bridge to inlet of Horseshoe Pond, Wareham | Pathogens |
| Weweantic River | MA95-05 | Outlet Horseshoe Pond, Wareham to mouth at Buzzards Bay, Marion/Wareham | Pathogens |

* Segments Needing Confirmation for all causes of impairment

Combined Sewer Overflows from the City of New Bedford discharge to Clark's Cove (outfalls 003-011), Buzzards Bay Outer Harbor (outfalls 012-018), the Acushnet River (outfalls 019-027 and 039-041), and to Buzzards Bay Inner Harbor (outfalls 028-037). The New Bedford CSO Facilities Plan was completed in September 1990 by Camp, Dresser, & McKee (CDM). The Plan divided the CSO area into 6 subareas and evaluated a range of CSO alternatives. A key consideration was the protection of the Clark's Cove area (CSO areas 1 and 2), which has swimming beaches and is among the most productive shellfish beds in the state (Brander 2002). The recommended plan called for:

- Subarea 1: CSO storage, with storage of up to the 3-month storm, and excess CSO flows redirected to the Inner Harbor instead of Clark's Cove, where CSO flows from this area presently discharge;
- Subarea 2: CSO storage, up to the 6-month storm, with excess CSO flows conveyed to Clark's Cove. This level of protection, which was in fact found to be *more costly* than complete sewer separation in this area, was identified during the planning process by DMF as being the level of control needed to reopen the shellfish beds. [It should be noted that those beds have been conditionally reopened at this time, despite the fact that the CSO abatement facilities have not been constructed.]
- Subareas 3, 4, 5, & 6: These areas all overflow to the Inner and Outer New Bedford Harbor. Sewer separation was the recommended plan in each of these subareas.

The cost of the 1990 recommended plan was \$191 million. The City is presently finalizing a scope of work to reassess the 1990 plan and financial capability will likely be a substantial constraint to implementation of extensive CSO controls (Brander 2002).

In recent years, the City of New Bedford has aggressively worked to eliminate discharges of untreated waters (Furtado 2003). Completed projects include:

- the construction of a state-of-the-art wastewater treatment facility (improving water quality),
- the demolition and reconstruction of four state-of-the-art pump stations (eliminating numerous overflows and dry weather discharges),
- the creation of a CSO crew that investigates all CSOs whenever there is at least 0.3 inches of rain and at a minimum of once every two weeks regardless of the weather,
- the daily patrol of the City's waters by City shellfish constables, complimented seasonally (April-October) by MA Environmental Police, to note and report any unusual discharges,
- the daily operation of City street sweepers and catch basin cleaners,
- the elimination of approximately 200 cross connections, following dye testing at thousands of properties, reviewing films of sewers, and identification through general maintenance (daily rodding, jetting, and vac-truck use),
- the upgrade of approximately eight (in recent years) collection systems to separate the storm water from sanitary waste water thereby eliminating the discharge of numerous gallons of untreated waters, and
- the elimination of eleven CSOs (Apponogansett St., Seymour St., Gifford St., Pearl St., Wamsutta St. at Acushnet Ave., Kenyon St. at N. Front St., Howard Ave., Coggeshall St., Butler St., Cove St. at East Rodney French Blvd., and Ricketson St) by redirecting flows and new sewer installations.

The 1990 Plan was developed prior to the 1994 federal CSO policy and the 1997 MA DEP CSO Guidance. At that time no efforts were made to modify the water quality standard (which would need to be done in any case where CSOs are not eliminated). Therefore, the continued CSO discharges continue to violate water quality standards. The upcoming Plan reassessment will focus on identifying the highest feasible level of CSO control. The final CSO Plan will have to be integrated with the water quality standards, and the standards modified as necessary pursuant to all procedural requirements (Brander 2002).

SOURCES OF INFORMATION

Multiple local, state and federal agencies provided information used in the water quality assessment of the Buzzards Bay Watershed. Within the MA DEP information was obtained from three programmatic bureaus: Bureau of Resource Protection (BRP, see below), Bureau of Waste Prevention (BWP, industrial wastewater discharge information) and the Bureau of Waste Site Cleanup (hazardous waste site information). Specifically, the BRP Division of Watershed Management (DWM) Watershed Planning Program provided water quality, habitat assessment and biological data (Appendix C), lake synoptic survey data (Appendix A), and toxics in fish flesh data (Appendix B). The MA DEP Southeast Regional Office, Buzzards Bay Watershed Team, MA DEP DWP and the DWM Watershed Permitting Program (Water Management Act and National Pollutant Discharge Elimination System permits) provided water withdrawal and wastewater discharge permit information (Appendix F). [Note: The BRP DWP evaluates the status of the *Drinking Water Use* and this information is, therefore, not provided in this assessment report.] Projects funded through various MA DEP grant and loan programs also provide valuable information that may be used in the water quality assessment report. A summary of these projects for the Buzzards Bay Watershed is provided in Appendix D.

Federal

The United States Environmental Protection Agency, in partnership with the National Oceanic and Atmospheric Administration, the Army Corps of Engineers, the United States Fish & Wildlife Service, and the Commonwealth of Massachusetts, is working to clean up and restore New Bedford Harbor as a result of PCB and heavy metal contamination. Clean up is ongoing and will take more than ten years to complete. Two rounds of restoration activities not directly related to the clean up have been proposed. Round One is currently underway with some projects already completed. Projects funded during Round One include Restoration of Padanaram Salt Marsh, construction of two recreational parks, installing an additional opening in the hurricane barrier to increase tidal exchange, restoring eel grass beds, herring runs, and roseate tern nesting colonies, developing a master plan for open space planning, and inventory wetlands for future restoration. Funding has been secured for 17 projects in Round Two. Additional information is available online from the New Bedford Harbor Superfund website: <http://www.darp.noaa.gov/neregion/newbed.htm>

The United States Army Corps Of Engineers (ACOE) is charged with reducing flood damage and implementing controls, preparing for and responding to natural disasters, remediating and restoring the environment, protecting stream banks and shorelines, maintaining navigation on the country's waterways, as well as supporting the military. In the Buzzards Bay Watershed, the New England District operates and maintains two hurricane barriers and the Cape Cod Canal. Additionally, the New England District is responsible for the dredging of Buttermilk Bay, New Bedford/Fairhaven and Westport harbors and assisting the EPA with remediation at three Superfund sites. Each project is described in more detail in the segment within which it is located.

The United States Geologic Survey (USGS) maintains one stream gage in the Buzzards Bay Watershed (01150933) located in the Paskamanset River near South Dartmouth. The period of record for this gage is October 1995-present (Socolow *et al* 2001).

State

Many of the rivers and estuaries in the Buzzards Bay Watershed receive the discharge of treated municipal and industrial wastewater, contact and non-contact cooling water, and storm water (MA DEP 2002b). Below is a summary of the NPDES permits issued for the Buzzards Bay Watershed.

Publicly Owned Treatment Works (POTWs), Waste Water Treatment Plants (WWTPs), Water Pollution Control Facilities (WPCFs): There are five facilities that discharge into the Buzzards Bay Watershed. These facilities treat wastewater from domestic and industrial sources within the WWTP service area.

- The Town of Marion (MA0100030) is permitted (30 November 1998) to discharge 0.5 million gallons per day (MGD) of treated sanitary wastewater via outfall 001 to an unnamed tributary to Aucoot Cove. The permit will expire in 2003. The facility's whole effluent toxicity limit is C-NOEC

and $LC_{50} > 100\%$ effluent. The current permit includes secondary limits: Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) = 10 mg/L; fecal coliform bacteria = 200 cfu/100mL; and seasonal ammonia nitrogen limits (May 1 to June 14 = 2.6 mg/L and June 15 to October 15 = 1.74 mg/L). Marion received a Clean Water State Revolving Fund Loan to upgrade the existing treatment plant in FY2003. Upgrades will provide pretreatment (grit and screenings removal) and sequencing batch reactors (SBRs) for ammonia removal and will reduce the nitrogen load to Aucoot Cove and Buzzards Bay. The plant construction will begin in August 2003 and the plant should begin startup in spring 2005.

- The Town of Dartmouth (MA0101605) is permitted (17 October 1998) to discharge 4.2 MGD of wastewater treatment plant effluent via outfall 001 to Buzzards Bay. The permit will expire in 2003. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent and C-NOEC $\geq 11\%$ effluent. The current permit includes secondary limits: BOD and TSS = 30 mg/L and fecal coliform bacteria = 200 cfu/100mL. Between January 1996 and July 2002, Dartmouth conducted 13 whole effluent toxicity tests for outfall 001 (to Buzzards Bay via an offshore outfall south of Salters Point and east of Mishaum Point) using the inland silverside, *M. beryllina*. The facility was in compliance with their permit limits; LC_{50} s were all greater than 100% effluent and C-NOEC's ranged between 50 and 100% effluent. Survival of *M. beryllina* in ambient water was good (range 88-100%).
- The Town of Dartmouth (MA0033588) is also permitted (16 September 1992) to discharge emergency overflow from lagoons from the water treatment plant via outfall 001 which discharges to the ground and ultimately to the Paskamansett River. This facility has never discharged (Burns 2003).
- The City of New Bedford (MA0100781) is permitted (2 January 2001) to discharge 30 MGD of treated effluent via outfalls 001 and 002 to Buzzards Bay. The permit expires in 2006. The facility's whole effluent toxicity limit is $LC_{50} > 100\%$ effluent and C-NOEC $> 12.5\%$ effluent. The current permit includes secondary limits: Chemical Biological Oxygen Demand = 25 mg/L; TSS = 30 mg/L; fecal coliform bacteria = 200 cfu/100mL; TRC = 67.5 ug/L; Total Copper = 33.6 ug/L and Total Nickel = 74.5 ug/L. Concentrations of TRC reported in the facilities whole effluent toxicity tests between October 1996 and October 2002 ranged from BDL and 0.850 mg/L.
- The Town of Wareham (MA0101893) is permitted (30 October 1991) to discharge 1.8 MGD of treated sanitary wastewater via outfalls 001-004 to the Agawam River. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent and C-NOEC $\geq 14\%$ effluent. The permit includes secondary limits: BOD = 10 mg/L, TSS = 10 mg/L, fecal coliform bacteria = 88cfu/100mL, and TRC = 91 ug/L. This facility's permit is currently in the process of being renewed. The draft permit was released for public comment and contains a flow decrease to a maximum of 1.47 MGD and a seasonal total nitrogen limit of 4.0 mg/L. It is likely that the permit will have a flow limit of 1.57 MGD as a result of an error in the Inflow/Infiltration (I/I) calculation (Hogan 2003). Wareham plans to upgrade the WPCF to include a new headworks facility with new septage receiving system, two flow equalization basins, a new biological nutrient removal process, UV disinfection system, a biofiltration odor control system, one new 18" outfall pipe, a new solids thickening process. Additionally, the Town plans to extend the sewer to 12 "needs" areas. The facility, operational since 1972, currently provides secondary treatment through conventional activated sludge processes followed by disinfection and filtration (CDM 2001a and 2001b).
- The Town of Fairhaven (MA0100765) is permitted (21 March 2003) to discharge 5 MGD treated sanitary wastewater via outfall 001 to the Acushnet River (New Bedford Inner Harbor). The facility's whole effluent toxicity limit is a maximum daily $LC_{50} = 100\%$ effluent. The permit includes secondary limits for BOD = 45 mg/L, TSS = 45 mg/L, fecal coliform bacteria = 260 cfu/100mL, and TRC = 107ug/L maximum daily. The permittee is required to install an ultraviolet ray (UV) disinfection system by April 1, 2004 to meet the more stringent TRC limits. (The prior permit limit of 0.29 mg/L TRC will remain in effect until April 2004.) An Infiltration and Inflow Plan must be developed and implemented to eliminate all unauthorized discharges. Furthermore, by October

2004 a Nitrogen Removal Optimization Study must be submitted to identify operational criteria that can achieve maximum practicable removal of nitrogen at the existing facility.

Combined Sewer Overflows (CSOs): There is one permittee discharging CSO into the Buzzards Bay Watershed, which is summarized below (Brander 2002).

- City of New Bedford (MA0100781) discharges via nine CSO locations to Clark's Cove (outfalls 003-011), seven CSOs to Buzzards Bay Outer Harbor (outfalls 012-018), 12 CSOs to the Acushnet River (outfalls 019-027 and 039-041), and nine CSOs to Buzzards Bay Inner Harbor (outfalls 028-037). The permit will expire 2 January 2004.

Power Plants: Mirant Canal L.L.C. (formerly Southern Energy Canal L.L.C. and Canal Electric), located in Sandwich on the Cape Cod Canal, is a 565 megawatt oil and gas-fired power-generating unit. The facility is permitted (MA0004928, 23 June 1989) to discharge:

- 518 MGD of condenser cooling water via outfall 001 (86°F temperature limit and a TRC limit of 0.1 mg/L),
- 2.5 MGD of intake screen sluice and flume flushing water via outfall 002 (90°F temperature limit),
- 0.072 MGD of floor and equipment drain No. 1 via outfall 010 (oil & grease = 10 mg/L),
- 0.25 MGD of equipment washes, chemical cleaning, and ash sluice blowdown via outfall 011 (total copper = 1.0 mg/L, total iron = 1.0 mg/L, TSS = 30 mg/L, oil & grease = 10 mg/L), and
- 0.07 MGD demineralizer and condensate polisher wastes via outfall 012 (TSS = 30 mg/L, oil & grease = 15 mg/L).

Hydroelectric power plants: There are no Federal Energy Regulatory Commission (FERC) licensed hydroelectric power plants in the Buzzards Bay Watershed. There is, however, one FERC-exempt power-generating facility, which is briefly described below.

| Project Name | Project Number | Owner Name/Issuance date | River/Location | Kilowatts |
|-------------------|----------------|------------------------------|-----------------|-----------|
| Wareham (Tremont) | 3894 | Town of Wareham /27 May 1981 | Weweantic River | 300 |

Other Industrial Discharges: There are several industries within the Buzzards Bay Watershed that have permits for the discharge of contact cooling water, non-contact cooling water (NCCW), and storm water. These discharges can be authorized and controlled under either a general or an individual permit.

- Massachusetts Maritime Academy (MA00243680) is permitted (20 April 2001) to discharge 0.14 MGD treated sanitary wastewater and untreated boiler water blow-down via outfall 001 and 10,000 GPD treated swimming pool discharge water via outfall 002 to the Cape Cod Canal. The facility's whole effluent toxicity limit is $LC_{50} \geq 50\%$ effluent. The existing facility is an extended aeration facility that provides secondary wastewater treatment. A new facility will be constructed to replace the existing facility and will also provide secondary treatment. New processes will include influent screening, influent pumping, an alkalinity addition system, two sequential batch reactors for sludge treatment and UV disinfection units. The current permit includes secondary limits for both the existing facility and upgraded facility: BOD and TSS = 30 mg/L; fecal coliform bacteria = 100 MPN/100mL (existing facility); and 14 MPN/100mL (upgraded facility). A TRC limit of 1.0 mg/L daily is allowed until the UV disinfection system becomes fully operational.
- The City of New Bedford (MA0034428) is permitted (24 June 1992) to discharge site dewatering discharges via outfalls 045, 046, and 047 to Clark's Cove and storm water via outfalls 042-044 to Clark's Cove and Outer New Bedford Harbor. The permit expired in 1997. The facility's permit includes a Total Petroleum Hydrocarbon (TPH) limit of 5 mg/L maximum daily and a 50 mg/L maximum daily TSS limit for the site dewatering discharges and a 5 mg/L maximum daily TPH limit for storm water.
- Cornell-Dubilier Electronics Corporation (MA00003930) is permitted (28 February 2001) to discharge storm water via outfall 002 to Fort Phoenix Reach near the Acushnet River Estuary in Lower New Bedford Harbor. The permit will expire in 2006. Cornell-Dubilier Electronics operated a capacitor manufacturing operation. From the 1940s-1978, the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was

required to monitor storm water discharges at the site due to residual PCB contamination. See Summary of Existing Conditions and Perceived Problems for additional information.

- Tremont Nail Company (MA0005801) is permitted (18 February 1986) to discharge 60,000 GPD of contact cooling water from heat quench tanks via outfall 001 to the Wankinco River. The permit includes an 81°F temperature limit and also includes secondary limits for TSS= 20 mg/L, oil & grease = 15 mg/L and total iron =2.0 mg/L (dissolved iron = 1.0 mg/L).
- Acushnet Company- Titleist Golf Division (MA0005428) is permitted (20 November 1986) to discharge sanitary waste via outfall 008 and treated process waste, NCCW, and boiler blow-down from outfall 010 to the Acushnet River. The permit includes a 92 °F temperature limit for outfall 010 and secondary limits for BOD= 30 mg/L, TSS = 30 mg/L, oil & grease = 10 mg/L, fecal coliform bacteria = 200cfu/100mL.
- Acushnet Company- Rubber Division (MA0003913) is permitted (20 November 1986) to discharge 0.75 MGD of non-contact cooling water (NCCW) via outfall 001 and storm runoff via outfalls 002 and 003 to the Acushnet River. The permit includes a temperature limit of 80°F as well as limits for total chromium= 0.3 mg/L, oil & grease= 15 mg/L maximum daily, and TSS= 9lbs/day.
- Aerovox Inc. (MA0003379) is permitted (17 December 2000) to discharge storm water via outfalls 003 and 005-007 to the Acushnet River/New Bedford Harbor. The permit includes an oil & grease limit = 15 mg/L. Aerovox operated a capacitor manufacturing operation from 1978-2001. From the 1940s-1978, the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was required to monitor storm water discharges at the site due to residual PCB contamination. See Summary of Existing Conditions and Perceived Problems for additional information.
- Old Rochester Regional School District (MA0102318) is permitted (30 October 1998) to discharge 0.0225 MGD effluent to Coen Brook, a tributary to Mattapoissett Harbor, from POTW outfall 001. The facility's whole effluent toxicity limit is LC₅₀= 100% effluent and C-NOEC = 64%. The permit includes secondary limits: BOD= 30 mg/L, TSS =30 mg/L, fecal coliform bacteria= 200 cfu/100mL, TRC= 0.017 mg/L, and total ammonia= 2.7 mg/L. The permit will expire in 2003. Old Rochester Regional School District tied in to the Mattapoissett sewer system in the summer of 2002 (Greenway 2003).
- Revere Copper Products, Inc (MA0004821) is permitted (26 December 2000) to discharge plate mill cooling, hot breakdown mill, hot breakdown furnace, and hot roll mill discharge via internal outfall, treated wastewater from sheet washing, plate washing, boiler condensate and chemical wastewater via internal outfall 002A, and 165,000 gpd of compressor cooling, furnace cooling, boiler condensate blowdown, and storm water via outfall 002 (includes discharges resulting from internal outfalls 002A and 004B) to the Acushnet River. The permittee is also authorized to discharge storm water via outfall 004C. The facility's whole effluent toxicity limit is LC₅₀= 100% effluent and temperature limit = 85°F. The permit also includes secondary limits: Outfall 002B-- TSS= 30 mg/L, oil & grease= 15 mg/L, total chromium= 0.4 mg/L, total copper= 0.7 mg/L, total lead= 0.2 mg/L, total nickel= 1.8 mg/L, and total zinc= 1.2 mg/L; Outfall 002A-- TSS= 30 mg/L, total chromium= 0.6 mg/L, total copper= 1.5 mg/L, total lead= 0.4 mg/L, total nickel= 1.5 mg/L, and total zinc= 1.5 mg/L; Outfall 002-- TSS= 20 mg/L, total chromium= 0.6 mg/L, total copper= 0.7 mg/L, total lead= 0.4 mg/L, total nickel= 1.5 mg/L, and total zinc= 1.5 mg/L.
- Trio Algarvio Inc. (MA0110329) is permitted (20 March 1996) to discharge 0.15 MGD via outfalls 001 and 002 to New Bedford Inner Harbor. The permit includes secondary limits for BOD= 30 mg/L and TSS= 30 mg/L. Trio Algarvio owns a fish processing plant for monkfish and whiting and a fish farm for raising summer flounder.
- Eastern Energy Corporation (MA0034274) is permitted (17 July 1992) to discharge to wetlands adjacent to Acushnet Cedar Swamp via outfalls 001-003. (In 1995, Eastern Energy was a proposed bituminous coal-fired energy facility that would burn 1,161,576 tons/year <http://www.state.ma.us/dep/files/mercury/hgch3c.htm>)
- Goodyear Tire and Rubber (MA0005606) is permitted (5 August 1986) to discharge 0.5 MGD NCCW and storm water via outfall 001 to Clark's Cove. The permit includes a temperature limit of 80°F, TSS= 10 mg/L, and oil & grease= 5 mg/L.
- Lobster Trap Company (MA0029092) is permitted (August 2, 1993) to discharge 7456 GPD of treated wastewater from one outfall into the Back River, Bourne. The permit includes limits for

TSS= 30 mg/L, BOD of 30 mg/L, and fecal coliform concentrations not exceeding class SA water quality standards.

Storm water

Phase I of the EPA's storm water program was promulgated in 1990 under the Clean Water Act and relies on NPDES permit coverage to address storm water runoff from medium and large municipal separate storm sewer systems (MS4s) generally serving populations of 100,000 or greater, construction activity disturbing five acres of land or greater, and ten categories of industrial activity.

Phase II expands the original program to certain small MS4s in urbanized areas and uses six minimum control measures to reduce the discharge of pollutants to the maximum extent practicable, protect water quality, and satisfy requirements of the Clean Water Act. The six measures are public education and outreach, public participation/involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, pollution prevention and good housekeeping (EPA 25 June 2002). More information on EPA's storm water program is available online at http://cfpub1.epa.gov/npdes/home.cfm?program_id=6. All communities in the Buzzards Bay Watershed (Fall River, Westport, Dartmouth, New Bedford, Acushnet, Freetown, Fairhaven, Carver, Marion, Mattapoisett, Wareham, Plymouth, Bourne, Rochester, and Falmouth) must submit Notices of Intent (NOIs) to obtain Phase II NPDES storm water general permit coverage for their municipal drainage systems. Additionally, the communities are required to develop, implement, and enforce a storm water management program to reduce the discharge of pollutants from their system, over the five-year permit term. A summary description of the storm water management program is part of the Notice of Intent. The final version of the Phase II storm water general permit for regulated small municipal separate storm sewer systems was published on 1 May 2003. Permit applications from the communities were due to EPA and MA DEP by 30 July 2003. Each community will receive authorization to discharge when a complete Notice of Intent has been verified by EPA and MA DEP (Scarlet 2003).

Water Management Act

The Department of Environmental Protection's Water Management Program reviews the compliance of each permitted and registered public water supply entity with its compliance with total permitted and registered withdrawal volumes; water conservation standards of the Commonwealth, wellhead protection measures, and any specific permit conditions such as wetlands and streamflow monitoring requirements. The WMA Program seeks to involve the technical expertise of the Department of Environmental Management in developing permit-specific monitoring conditions and any subsequent amendments to them. Monitoring results from permits where long-term data has been evaluated indicate that wetlands monitoring that focuses on vegetative changes, alone, has not proven to be the optimal method of evaluating the impacts of withdrawals. More recent wetlands monitoring conditions have been written to include hydrologic monitoring, as well. In general, interpretation of both wetlands and hydrologic results is obscured by the complexities induced by other, unquantified basin impacts. Without an understanding of streamflow requirements for the protection of all potentially impacted flora and fauna, combined with a quantified water balance for each of the major watersheds and for some of the more highly utilized sub basins, true "management" of the Commonwealth's waters remains an unreach goal.

Site specific evaluations of other water quality issues in Buzzards Bay related to either wastewater discharges or water withdrawals were conducted by MA DEP DWM either through field investigations (where resources could be allocated) or through the review of discharge monitoring reports and annual water withdrawal reports submitted by the permittees.

TOXTD

The five WWTP's in the Buzzards Bay Watershed and two industrial dischargers submit toxicity testing reports to EPA and MA DEP as required by their NPDES permits. Data from these toxicity reports are maintained by DWM in a database entitled "Toxicity Testing Data - TOXTD". Information from the reports includes: survival of test organisms exposed to ambient river water (used as dilution water), physicochemical analysis (e.g., hardness, alkalinity, pH, total suspended solids) of the dilution water, and the whole effluent toxicity test results. Data from 1996 to 2002 were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Buzzards Bay Watershed.

Toxicity testing data is required in the following NPDES permits:

- Wareham WWTP MA0101893
- Dartmouth WWTP MA0101605
- New Bedford WWTP MA0100781
- Town of Marion MA0100030
- Fairhaven WWTP MA01000765
- Revere Copper MA0004821
- Massachusetts Maritime Academy MA0024368

MDPH

In 1994, the Massachusetts Department of Public Health (MDPH) issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MDPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts, and therefore, the *Fish Consumption Use* cannot be assessed as support. In July 2001, MDPH issued a new, more inclusive, fish consumption advisory for both fresh and salt waters in the Commonwealth (MDPH 2001). Currently, there are three site-specific freshwater fish consumption advisories for water bodies in the Buzzards Bay Watershed (Copicut River (including Cornell Pond), Noquochoke Lake, and Turner Pond) because of PCB contamination and elevated mercury concentrations in fishes (MDPH 2002c). Additionally, there is saltwater fish consumption advisory for New Bedford Harbor (including Clarks Cove and Apponagansett Bay) due to PCB contamination (MDPH 2001a and EPA May 2002).

The MDPH Bureau of Environmental Health Assessment annually provides a fact sheet that addresses health concerns related to the recreational use of selected water bodies, including the nearshore waters of Buzzards Bay, and reflects the results of chemical testing at the Massachusetts Military Reservation. To review the latest fact sheet, see <http://www.state.ma.us/dph/beha/epi/reports/cape/pond%5Ffact%5Fsht.htm>.

DFWELE

The Department of Fisheries, Wildlife & Environmental Law Enforcement (DFWELE) was composed of four divisions: The Division of Marine Fisheries (DMF), The Division of Fisheries and Wildlife (MassWildlife), the Public Access Board (PAB), and the Environmental Law Enforcement Division. [NOTE: This agency is now called the Department of Fish and Game.]

DFWELE (MassWildlife) conducted fish population surveys in eleven lakes within the Buzzards Bay Watershed during the summers of 1998-2002. The species list and counts for fish are provided in the lakes assessment section, Tables 5 and 6. A watershed-based fisheries management plan will be produced by DFWELE at a later date.

The Division of Marine Fisheries Shellfish Management Program maintains information used to classify their shellfish management areas (e.g., approved, conditionally approved, prohibited). These classifications are subsequently used to regulate the harvesting of various shellfish (DFWELE 2000). DMF shellfish management areas include acreage in the Buzzards Bay Watershed not specifically addressed (i.e., designated as a segment) in this report. Appendix E includes the complete listing of DMF shellfishing closures as of July 2000 in the Buzzards Bay Drainage Area. Maps of DMF's shellfish growing areas can be obtained online at the address below:

<http://www.state.ma.us/dfwele/dmf/ProgramsAndProjects/dsga.htm#shelsani>

DMF conducts fecal coliform bacteria sampling as part of their sanitary surveys by which shellfish growing area classifications are assigned. These surveys also include shellfish species identification, habitat location, relative abundance and documentation of related fisheries. A shoreline survey is conducted to identify pollution sources and evaluate potential impacts with the understanding that hydrographic characteristics may influence contaminant distribution and removal over the growing area. Supplementary analysis may be required for naturally occurring pathogens (i.e., *Vibrio* spp.), marine biotoxins (i.e., Paralytic Shellfish Poisoning) as well as hazardous wastes in growing areas with a known history of contamination by these harmful substances.

Sanitary surveys must be repeated at least every twelve years for all growing areas with the exception of those classified as Prohibited (Kennedy 2001). However, survey information is updated through annual and triennial reports and classifications are maintained with extensive monitoring. A growing area classification may be downgraded and management plans amended, based on the findings of annual and triennial reviews. Classification upgrades can only be made based on the findings of a full sanitary survey.

DMF provided technical assistance for work in and around New Bedford Harbor and at the Buzzards Bay Disposal Site near Cleveland Ledge. Additionally, DMF has performed a bi-annual trawl survey along the entire coast for the last 24+ years (Malkoski 2002).

The Public Access Board, the smallest of the agencies within the Department of Fisheries, Wildlife & Environmental Law Enforcement, provides boat and canoe access sites at more than 200 locations on coastal waters, ponds, and rivers throughout Massachusetts, including 10 in the Buzzards Bay Watershed. (Specific information can be found in the individual Segment descriptions.) The Board acquires property and easements for the purpose of providing access and designates roads and facilities to be built, improved, operated, and maintained. Boat launching facilities are managed by staff from the Division of Fisheries & Wildlife, the Department of Environmental Management, or municipal employees. Information about the location of public access sites is available through the PAB's website: http://www.state.ma.us/dfwele/PAB/pab_toc.htm.

MA DEM

The Massachusetts Department of Environmental Management (MA DEM) conducts bacteria monitoring at their public beaches in state forests, parks, and reservations. Data is maintained in a database by MDPH. MA DEM also awards Lake and Pond Grants to communities and citizen groups to monitor water quality and provide educational materials to the public about various lake issues. MA DEM Lakes and Pond Grant projects in the Buzzards Bay Watershed are discussed in the Lakes Assessment Section of this report. [NOTE: This agency is now called the Department of Conservation and Recreation, Division of State Parks and Recreation.]

MA DEP

The Massachusetts Department of Environmental Protection Division of Watershed Management (DWM) monitoring in the Buzzards Bay Watershed in 2000 included fish toxics monitoring at White Island Pond and Noquochoke Lake, baseline lake monitoring at eight lakes to support TMDL development, and benthic macroinvertebrate sampling upstream and downstream from the Marion POTW. Additional work conducted by DWM included benthic macroinvertebrate sampling, fish population sampling, and water quality monitoring at four stations in October 1996 as part of the Numeric Biocriteria Project in 1995-1996.

The Massachusetts Estuaries Project (MEP) is a collaborative project between MA DEP, EPA, the UMass Dartmouth School for Marine Science and Technology (SMASST), the Office of Coastal Zone Management (CZM), the Cape Cod Commission, and several municipalities to classify the nitrogen sensitivity of southeastern Massachusetts's coastal bays and estuaries. "SMASST technical experts will work with MA DEP to evaluate the nitrogen sensitivity through comprehensive water quality testing, quantitative TMDL modeling, and preparation of technical reports allowing communities to consider how implementation of nitrogen management scenarios within watersheds will influence water quality in embayments. The major project goals are to: (1) develop a coastal TMDL working group for coordination and rapid transfer of results, (2) determine the nutrient sensitivity of each of the 89 embayments in southeastern Massachusetts, (3) provide necessary data collection and analysis required for quantitative modeling, (4) conduct quantitative TMDL analysis, outreach, and planning, and (5) keep each embayment's model "alive" to address future regulatory needs (Howes *et al.* Undated)."

"The Estuaries Project is comprised of four phases relating to project design, project development, implementation of approach, and application of management models to on-going management issues. The project phases are further described as: *Phase I* - Assemble a working group, design the project organizational framework, evaluate existing management models and select appropriate approach for regional implementation, and survey existing data sources with regard to potential to support selected approach; *Phase II* - Determine the prioritization procedure and select initial embayments, promote water

quality data collection in embayments with insufficient baseline data, educate local stakeholders as to Project goals, approach, results and data needs and complete the assessment of existing data and data gaps. Also, establish necessary regulatory stakeholder committees and increase the analytical capability of the Project Team relative to collection of field data needed to support the management approach; *Phase III* - Implement embayment management approach on a 2-year cycle, which includes field data collection, modeling, reporting, and a significant level of public outreach. Year 1 focuses on site-specific data collection to fill data gaps, Year 2 focuses on modeling, synthesis, and evaluation of management options; *Phase IV* - Keep quantitative models and embayment specific management approaches “alive” for future DEP and other management/planning needs and to provide a platform (upon request) for tracking embayment changes (Howes *et al.* Undated).”

The Estuaries Project is currently in Phase III. The *Embayment Water Quality Assessment Interim Report Priority Embayments 1-20* was published in September 2002 and provides water quality and bacteriological assessments for the first 20 priority embayments. Embayments discussed in this report pertinent to the Buzzards Bay Watershed include the West Falmouth Harbor System, the New Bedford Inner Harbor System, and the Wareham River System. Additional information on the Estuaries Project is available on the MA DEP website at <http://www.state.ma.us/dep/smerp/smerp.htm>.

Additionally, MA DEP provides funding for various grant and loan programs that provide valuable information that may be used in the water quality assessment report. A summary of these projects for the Buzzards Bay Watershed is provided in Appendix D.

CZM

As part of the National Coastal Assessment -- Coastal 2000, the Massachusetts Office of Coastal Zone Management is coordinating a comprehensive assessment of the Commonwealth's coastal sediments, waters, and biota. Staff from UMass Boston, UMass Dartmouth-SMAST, and CZM collected nutrient, total suspended solids, and chlorophyll *a* discrete samples; measured dissolved oxygen, temperature, conductivity, pH, and light attenuation *in situ*; conducted sediment sampling and analysis for chemistry and toxicity, and surveyed the macrobenthic community structure at seven stations in the Buzzards Bay Watershed. Three of these stations are in current Buzzard Bay segments; two on the Westport River and one on the Wareham River. Additionally, DMF examined the fish community from seven stations within the Buzzards Bay Watershed (Krahforst 2000). In 2003, 15 stations will be added in Buzzards Bay.

The Buzzards Bay Project has been mapping storm water discharges to Buzzards Bay and along streams near the coast to create the *Buzzards Bay Stormwater Atlas*. All known storm water discharge pipes and road-cuts have been inventoried, using maps and tables, in the towns of Westport, Dartmouth, Fairhaven, Mattapoisett, Marion, Wareham, Bourne, and Falmouth. BBP is establishing priorities for storm water remediation based on drainage system size and available water quality data of the storm water discharges and the receiving surface waters. The Atlas is summarized, and the draft report is posted on the BBP website at <http://www.buzzardsbay.org/stormatlas/stormatlas.htm>.

Local Monitoring

Between October 1987 and October 1998, Dr. Jefferson Turner, students, and research associates of the University of Massachusetts-Dartmouth School of Marine Science and Technology conducted 141 monitoring cruises of Buzzards Bay. Eight stations were monitored for the following parameters: temperature, salinity, Secchi depth, ammonium, nitrate+nitrite, phosphate, silicate, chlorophyll *a* + phaeopigments, and bacterioplankton abundance. They concluded that Buzzards Bay is a favorable habitat for phytoplankton with the waters “well-mixed and well-illuminated and nutrient replete” (Turner *et al* 2000). Additionally, Turner *et al.* (2000) noted that the New Bedford sewage outfall had localized negative impacts on the water quality of New Bedford Harbor prior to upgrading to secondary treatment in September 1996.

The Coalition for Buzzards Bay (CBB) is a membership-supported non-profit organization “dedicated to the restoration, protection, and sustainable use and enjoyment of our irreplaceable Bay and its watershed”. The Coalition strives to improve the health of the Bay ecosystem for all through education, conservation, research, and advocacy (www.savebuzzardsbay.org). The Coalition's Baywatchers conduct weekly monitoring in the 28 major harbors and coves in Buzzards Bay. In accordance with an EPA

approved Quality Assurance Project Plan, weekly samples are collected from May to September and analyzed for dissolved oxygen, temperature, salinity, and water clarity. Additionally, biweekly sampling for nutrients is conducted in July and August (Howes *et al.* 1999). While for various reasons these data were not used for use impairment decisions, MA DEP did utilize these reports to identify sources of impairment and areas of concern. Any segment that was shown to have a low health index score was identified at least with an Alert Status for further investigation.

The Westport River Watershed Alliance (WRWA, <http://www.wrwa.com>) is dedicated to promoting the environmental integrity of the watershed and its coastal environs, to advocating the wise use and preservation of natural resources in the watershed for the aesthetic, recreational, and economic benefit of the citizens of the area, and to educating the general public about the interrelationship of our waters, soils, plants, animals, and people (WRWA undated). In 1995, the Westport River Watershed Alliance initiated its Adopt-A-Watershed Project (AAW). The purpose of AAW is to develop a prototype for watershed management while involving local residents as stewards of their backyard watersheds. As part of the AAW, fifteen stations on the Westport River and its tributaries were monitored for temperature, salinity, pH, turbidity, and fecal coliform and *E. coli* bacteria between March and October 2001 (WRWA 2001).

Mass Community Water Watch (<http://www.waterwatchonline.org/ma/>) conducted a shoreline survey along the middle portion of the Acushnet River from the Hamlin Street Bridge to the Coggeshall Street Bridge. Monthly surveys were conducted between October 1999 and April 2000 at five stations. Volunteers noted water conditions (e.g., color, odor, scum, oil sheens), stream bank characteristics, discharge and runoff, and flora/fauna present (MCWW 2000).

The Weweantic River Stream Team conducted a shoreline survey of the Weweantic River in May 2001. Volunteers noted water conditions (e.g., substrate type, oil sheens), stream bank characteristics, and flora and fauna (WRST 2002). The stream team developed an action plan to address issues related to fish passage, recreation and access, cleanups, and water quantity.

Applied Science Associates (ASA) conducted a flushing analysis of the Acushnet River to support TMDL work. The analysis involved field sampling and numerical computations/modeling. The objective was to determine the flushing characteristics of the New Bedford Inner Harbor/Acushnet River Estuary and residence time of the Fairhaven Wastewater Treatment Plant effluent (ASA 2002b).

Applied Coastal Research and Engineering, Inc. was awarded a Massachusetts Watershed Initiative grant in FY 2002 to conduct flushing studies for the Slocums and Little River in Dartmouth. This involved collecting quality-assured field data (such as tidal cycle, bathymetry and streamflow) and developing hydrodynamic models for each embayment as well as the potential movement of water between the Slocums and Little River (Ruthven *et al.* 2003).

Camp Dresser & McKee (CDM) prepared an Environmental Notification Form (ENF) for the Town of Wareham Water Pollution Control Facility in July 2001. In preparation for the ENF, CDM conducted a water quality investigation of the Wareham River Estuary Complex in 1999. The study involved determining river stage, conducting stage-discharge studies, collecting tide data, freshwater nutrient sampling, estuarine sampling, tidal exchange sampling, WPCF sampling, and bathymetry. Data were collected from freshwater and estuarine locations in the Agawam, Wankinco, Weweantic, and Wareham Rivers (CDM 2000, 2001a, 2001b).

Environmental Science Services, Inc. (ESS) conducted a bacteriological non-point source pollution assessment of the East Branch Westport River during the fall and winter of 2001-2002. The project, funded through the Massachusetts Watershed Initiative (01-02/MWI), included wet and dry weather water quality sampling at fourteen locations, an assessment of land-use practices, and the development of designs for recommended structural Best Management Practices (BMPs) (ESS 2003).

ENSR International conducted a Diagnostic/Feasibility Study of New Bedford Reservoir for the Town of Acushnet. ENSR examined the physical, chemical, and biological features of the reservoir in the first phase of developing a management program for the reservoir. The study examined the watershed and

lake features by investigating land use practices; conducting surface water sampling for dissolved oxygen, temperature, pH, specific conductance, Secchi transparency, turbidity, total alkalinity, nitrate and nitrite (06 August only), ammonia, total Kjeldahl nitrogen, total phosphorus and ortho-phosphorus; collecting plankton samples; and surveying the aquatic vascular plant community (ENSR 2002).

In August 2001, the Massachusetts "Beach Bill" was enacted by the legislature and signed by the Governor (MGL. C111. S5S). This act created minimum standards for public bathing waters adjacent to any public or semi-public bathing beach in the Commonwealth. A "public bathing beach" is defined as a beach open to the general public whether or not any entry fee is charged that permits access to bathing waters. A "semi-public bathing beach" is defined as a bathing beach used in connection with a hotel, motel, trailer park, campground, apartment house, condominium, country club, youth club, school, camp, or similar establishment where the primary purpose of the establishment is not the operation of the bathing beach, and where admission to the use of the bathing beach is included in the fee paid for use of the premises. A semi-public bathing beach shall also include a bathing beach operated and maintained solely for the use of members and guests of an organization that maintains such bathing beach. Under the Beach Bill, the Massachusetts Department of Public Health was directed to establish minimum uniform water quality standards for coastal and inland beach waters as well as determining the frequency and location of testing, reporting requirements, and requirements for notifying the public of threats to human health or safety. *105 CMR 445.000: Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII)* outlines MDPH's guidelines for the Beach Bill and is available online at http://www.state.ma.us/dph/dcs/bb4_01.pdf. Additionally, under the Beach Bill and MDPH guidelines, local boards of health and state agencies are responsible for collecting samples from public beaches using testing procedures consistent with the American Public Health Association's *Standard Methods for Examination of Water and Waste Water* or methods approved by EPA. Operators of semi-public beaches are responsible for the costs of testing their beaches. Results of testing, monitoring, and analysis of public and semi-public beaches must be submitted in an annual report to MDPH by 31 October of each year (MDPH 2002a and b).

TOTAL MAXIMUM DAILY LOADS (TMDL)

As part of the Federal Clean Water Act states are required to develop Total Maximum Daily Loads (TMDL) for lakes, rivers, and coastal waters not meeting the states surface water quality standards as indicated by the states 303(d) List of impaired waters. A TMDL is the greatest amount of a pollutant that a waterbody can accept and still meet standards. Further information on the 303(d) List and the TMDL program is available on the MA DEP website at: <http://www.dep.state.ma.us/dep/brp/wm/wmpubs.htm>.

Under the Estuaries Project, UMass-Dartmouth School of Marine Science and Technology (SMAST) and MA DEP will assess 89 coastal embayments in southeastern Massachusetts. While the major focus of the project is on embayments impaired by nutrient loadings, those waters affected by bacterial contamination will also be considered. Assessments and management recommendations are to be based on sound water quality data and valid scientific and technical methodologies (MA DEP 2002a). Additional information is available on the MA DEP website at <http://www.state.ma.us/dep/smerp/smerp.htm>.

While the entire project is scheduled for completion in four phases over the course of six years, one initial phase involves the development of a prioritization procedure for selecting the embayments to evaluate further. All data and information will be assembled for each embayment and reviewed for adequacy and completeness. Data collection to fill information gaps will be planned and assessments will be completed to determine which embayments are actually impaired and in need of TMDLs as a step toward their restoration. To this end a standard methodology is being developed for assessing the embayments and, over the course of the project, assessments of the individual embayments will be completed and submitted to MA DEP. Those found to be impaired will be included with the 303(d) List Of Waters (i.e., Category 5 of the Integrated List) in future revisions. And, TMDLs and management recommendations will be developed (MA DEP 2002a). A complete list of waterbodies/systems (21 in the Buzzards Bay Watershed) that will be included in the Massachusetts Estuaries Project can be found as Appendix A of the 2002 Integrated List of Waters (<http://www.state.ma.us/dep/brp/wm/tmdls.htm>).

There are 24 ponds in the Buzzards Bay Watershed on the Massachusetts 1998 303(d) List of Waters for which the causes of impairment include noxious aquatic plants. Water quality monitoring was conducted in eight of these lakes in 2000: Turner Pond (MA95151), New Bedford Reservoir (MA95110), East White Island Pond (MA95166), West White Island Pond (MA95173), Crane Brook Pond (MA9595033), New Long Pond (MA95112), Federal Pond (MA95055), and Parker Mills Pond (MA95115).

The single draft TMDL report for total phosphorus, which is being developed for the eight lakes sampled in 2000, has been delayed until the *Cranberry Bog Phosphorus Dynamics TMDL Project* (DeMoranville 2001) has been completed (Mattson 2002).

Baseline lake surveys included the preparation of a bathymetric map (if not already available), mapping of aquatic vegetation, Secchi disc depth readings, *in situ* water quality profile measurements (i.e., temperature, pH, dissolved oxygen, percent saturation, specific conductivity) at one or more stations, water quality sampling for total phosphorus analysis at MA DEP's Wall Experiment Station (WES), algae (phytoplankton) counts and chlorophyll *a* determinations. Each of the ponds was visited on three separate occasions.

APRIL 2003 OIL SPILL IN BUZZARDS BAY

The following information on the April 2003 Buzzards Bay Oil Spill was excerpted from the Buzzards Bay National Estuary Project website ([HTTP://WWW.BUZZARDSBAY.ORG/OILSPILL-4-28-03.HTM](http://www.buzzardsbay.org/oilspill-4-28-03.htm)). This spill, as of 8 May 2003, affects 40 miles of shoreline throughout the watershed (see Figure 10 below). The assessments of the designated uses for waterbodies in the Buzzards Bay Watershed are reflective of information obtained prior to this spill. This oil spill will continue to have lasting environmental impacts on the aquatic life, recreation, shellfish harvesting, and aesthetic quality in Buzzards Bay.

It is believed that Bouchard Barge 120, a 25-year-old single hulled barge, owned by Bouchard Transportation Co. Inc., carrying 865,200 gallons of Number 6 ("Bunker C") fuel oil started leaking oil Sunday night (April 27), somewhere outside of Buzzards Bay, possibly in Rhode Island waters. Sometime Sunday the vessel arrived at Buoy 10 to facilitate the cleanup (about a distance of 18 miles). The anchorage is also called "Anchorage Lima" and is in central Buzzards Bay, about 5 miles WNW of Woods Hole in Falmouth and 3 Miles SE of West Island in Fairhaven. The starboard storage tank was reported ruptured on the bottom of the hull below the water, likely the result of striking bottom. On Monday (April 28), the Coast Guard estimated more than 14,700 gallons had already spilled from a 12-foot by 2-foot crack or gash on the underside of the barge. The oil barge was en route from Philadelphia to the Mirant Power Generating facility in Sandwich, which is located along the Cape Cod Canal. The problems were first reported by the Company 5:30 p.m. Sunday.

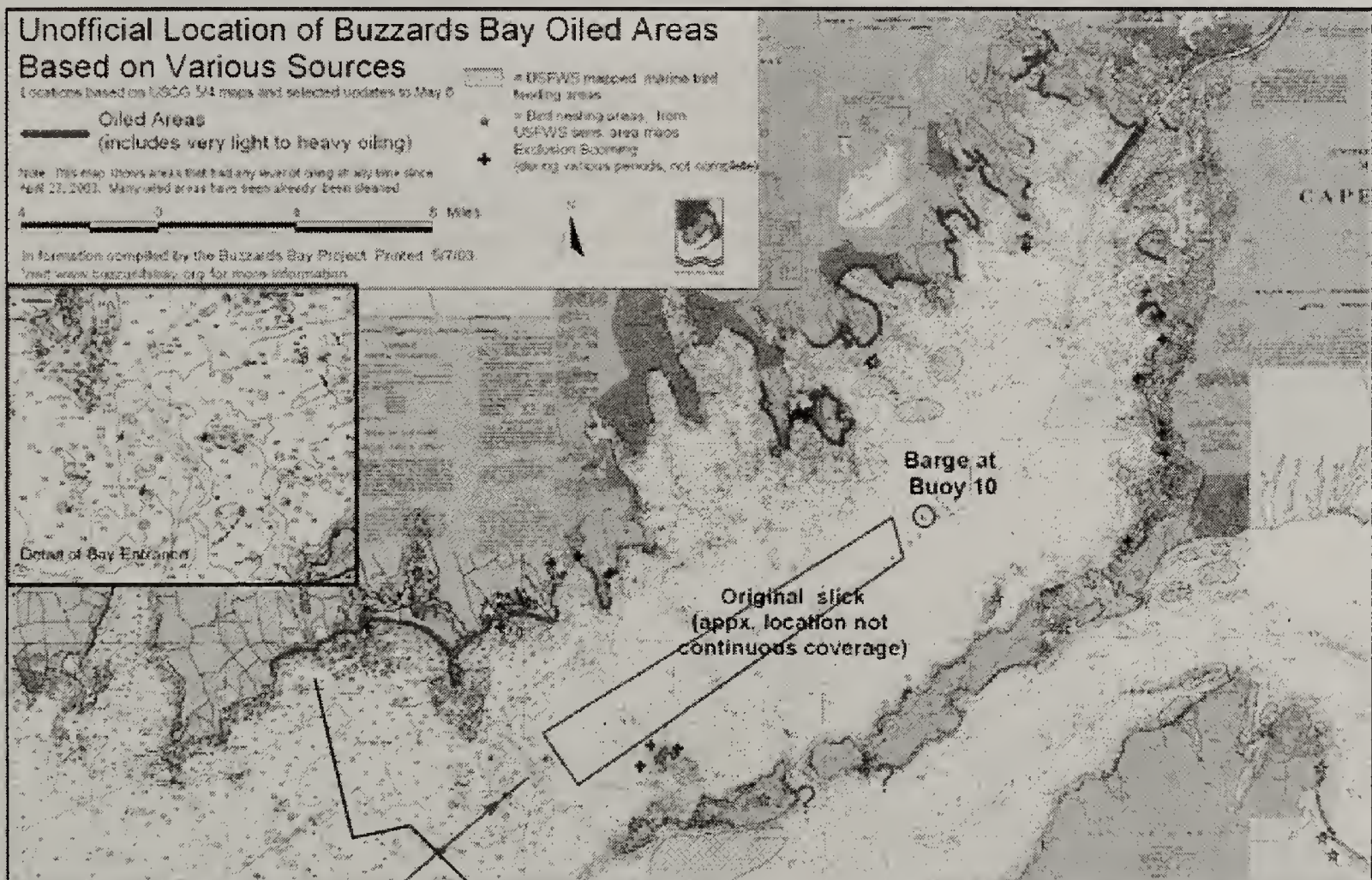


Figure 10. Location of Buzzards Bay Oiled Areas. Graphic Courtesy of Buzzards Bay Project.

Number 6 fuel oil is a heavy oil used by ocean liners and tankers as fuel and for oil burning power plants. It is thick, viscous, and sticky. Its consistency makes it ideal for sea-going skimming operations, but it is much more difficult to treat and cleanup when it lands ashore or on animals. Only 5-10% is expected to evaporate in the first few hours. Its specific gravity is very close to water, so it may float or sink, or do both. As the lighter hydrocarbons evaporate, the oil can become heavier, and sink. It will make a conspicuous "bath tub ring" along shore wherever it lands. Removal is needed where it lands because

degradation is very slow, taking months to years. "Adverse effects of floating No. 6 fuel oil are related primarily to coating of wildlife dwelling on the water surface, smothering of intertidal organisms, and long-term sediment contamination. Number 6 fuel oil is not expected to be as acutely toxic to water column organisms as lighter oils, such as No. 2 fuel oil. Direct mortality rates can be high for seabirds, waterfowl, and fur-bearing marine mammals, especially where populations are concentrated in small areas, such as during bird migrations or marine mammal haulouts." This is the largest oil spill in Buzzards Bay in 25 years and the forth largest recorded. It is also the largest spill of No. 6 Fuel, which can result in high bird and mammal mortality depending upon conditions and species affected.

Buzzards Bay is a major transit route for small tanker and barge traffic transporting heating and industrial oil and gasoline into Sandwich, greater Boston and northern New England markets. Nearly 1.6 billion gallons of oil pass through the canal annually with additional deliveries made to New Bedford. Buzzards Bay has been the site of several catastrophic oil spills. Between 1969 and the present, we estimate that over 1700 tons of petroleum have entered Buzzards Bay through documented oil spills.

The largest spill occurred in 1969 when 189,000 gallons of #2 fuel oil spilled when the barge *Florida* ran aground off West Falmouth. In recent years, improvements to navigation and more rigorous pilotage requirements are believed to be minimizing risks of future spills in Buzzards Bay. Nonetheless, smaller spills from barge and vessel groundings in the Bay have continued during the 1980s and 1990s. One of the more memorable of these was the grounding of the Queen Elizabeth II in 1992.

Please visit the Buzzards Bay Project and the Coalition for Buzzards Bay websites for updated information as it becomes available.

OBJECTIVES

This report summarizes information generated in the Buzzards Bay Watershed through *Year 1* (information gathering in 1999) and *Year 2* (environmental monitoring in 2000) activities established in the “Five-Year Cycle” of the watershed approach. Surveys conducted by DWM in 2000 were limited to fish toxics monitoring and baseline lake TMDL water quality monitoring. The fish toxics data are available in the technical memorandum entitled *2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys* TM-S-13 (Maietta and Colonna-Romano 2001). Additionally, at the request of EPA Region 1, DWM conducted benthic macroinvertebrate sampling upstream and downstream from the Marion POTW discharge in its unnamed receiving stream known locally as “Effluent Brook”. An unpublished technical memorandum, dated August 21, 2000, describes the results of this study. Together with other sources of information (identified in each segment assessment), the status of water quality conditions of rivers, ponds, and estuaries in the Buzzards Bay Watershed was assessed in accordance with EPA’s and MA DEP’s use assessment methods. Not all waters in the Buzzards Bay Watershed are included in the MA DEP/EPA Waterbody System Database or this report.

The objectives of this water quality assessment report are to:

1. evaluate whether or not surface waters in the Buzzards Bay Watershed, defined as segments in the WBS database, currently support their designated uses (i.e., meet surface water quality standards),
2. identify water withdrawals (habitat quality/water quantity) and major point (wastewater discharges) and nonpoint (land-use practices, storm water discharges, etc.) sources of pollution that may impair water quality,
3. identify the presence or absence of any exotic macrophytes in lakes,
4. identify waters (or segments) of concern that require additional data to fully assess water quality conditions,
5. recommend additional monitoring needs or remediation actions in order to better determine the level of impairment and to improve or restore water quality, and
6. provide information for the development of a Buzzards Bay Watershed action plan.

REPORT FORMAT

RIVERS/ESTUARIES/COASTAL EMBAYMENTS

The order of segments follows the Massachusetts Stream Classification Program hierarchy (Halliwell *et al.* 1982). Segments are organized hydrologically (from most upstream to downstream) and tributary segments follow after the segment into which they discharge. Each segment assessment is formatted as follows:

SEGMENT IDENTIFICATION

Name, Waterbody identification number (WBID), location, length, classification.

Sources of information: coding system (waterbody identification number, e.g., MA95-01) used by MA DEP to reference the stream segment in databases, such as 305(b) and 303(d), and the classification (MA DEP 1996a).

SEGMENT DESCRIPTION

Major land-use estimates (top three uses for the subwatershed excluding "open water") and other descriptive information.

Sources of information: USGS topographical maps, and land use statistics from a GIS analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1999 (UMass Amherst 1999).

SEGMENT LOCATOR MAP

Major waterbody locations, segment origin and termination points, and segment subwatershed (gray shaded).

Sources of information: Data layers published through MassGIS including the Hydrography (1:25,000) datalayer (MassGIS 2002).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

Water withdrawals and NPDES wastewater discharges (when provided):

Sources of information: Water Management Act (WMA) Database Printout (LeVangie 2002, O'Shea 2003, Drake 2003); open permit files located in Worcester and Lakeville MA DEP Offices (Burns 2003, MA DEP 2002b and c), New Bedford CSO status (Brander 2002), storm water permits (Scarlet 2003).

Cranberry Bog Cultivation:

For the purpose of this report, water use for cranberry cultivation within the subwatershed has been estimated by using a volume of 10 acre-feet of water per acre of bog per year (1 acre-foot = 325,900 gallons). The acreage of cranberry bog within the subwatershed has been estimated by using the MassGIS layer for Open Space – Cranberry Bogs. The figure of 10 acre-feet of water per acre of bog per year is based on a study conducted by the Cape Cod Cranberry Growers Association for the Massachusetts Water Management Act Program. It should be noted that this figure is used for "old style" bogs, those bogs that do not employ best management practices (BMPs) that conserve water. Most bogs constructed today, and many renovated older bogs, use BMPs, such as laser leveling, on-site reservoirs, tailwater recovery, etc., which result in reduced water usage (between 5 and 6 acre-feet of water per acre of bog per year). Therefore, the estimate of water usage within the subwatershed for cranberry cultivation is a conservative number (O'Shea 2002).

USE ASSESSMENT

Aquatic Life, Fish Consumption, Shellfish Harvesting, Drinking Water (where applicable – see note below), Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics.

Sources of information include: MA DEP eelgrass bed habitat data (Costello 2003), DWM 2000 Survey data (Appendices A, B and C), and the MA DEP DWM Toxicity Testing Database "TOXTD" were used to assess the *Aquatic Life Use* in selected segments. The MDPH Freshwater Fish Consumption Advisory List (MDPH 2002c) was used to assess the *Fish Consumption Use*; and the DMF Shellfish status report was used to assess the *Shellfish Harvesting Use* (DFWELE 2000). MDPH beach closure database information was used to assess the Primary Contact Recreational Use (MDPH 2002b). Where other sources of information were used to assess designated uses, citations are included.

[Note: Although the *Drinking Water Use* itself was not assessed in this water quality assessment report, the Class A waters were identified.]

SUMMARY

Use summary table (uses, status, causes and sources of impairment).

RECOMMENDATIONS

Additional monitoring and implementation needs.

LAKES

The lakes assessed in the Buzzards Bay Watershed, identified with their Waterbody System Identification (WBID) code numbers, are listed alphabetically in the Lakes Segment Assessment section of this report. Lake assessments were based on information gathered during DWM 1995 synoptic lake surveys and DWM 2000 Baseline Lakes surveys, as well as pertinent information from other sources (e.g., abutters, herbicide applicators, diagnostic/feasibility studies, MDPH, etc.). These lake surveys focused on observations of water quality and quantity (e.g., water level, sedimentation, etc.), the presence of native and non-native aquatic plants (both distribution and areal cover) and presence/severity of algal blooms (MA DEP 1995). In cases where it is best professional judgment that conditions have not changed since the 1995 surveys, these data were used for assessment purposes. Fish consumption advisory information was obtained from the MDPH to assess the *Fish Consumption Use* (MDPH 2002c). Although the *Drinking Water Use* was not assessed in this water quality assessment report, the Class A waters were identified. Information on drinking water source protection and finish water quality is available at the MDPH web site and from the Buzzards Bay Watershed public water suppliers.

BUZZARDS BAY WATERSHED RIVER AND ESTUARY SEGMENT ASSESSMENTS

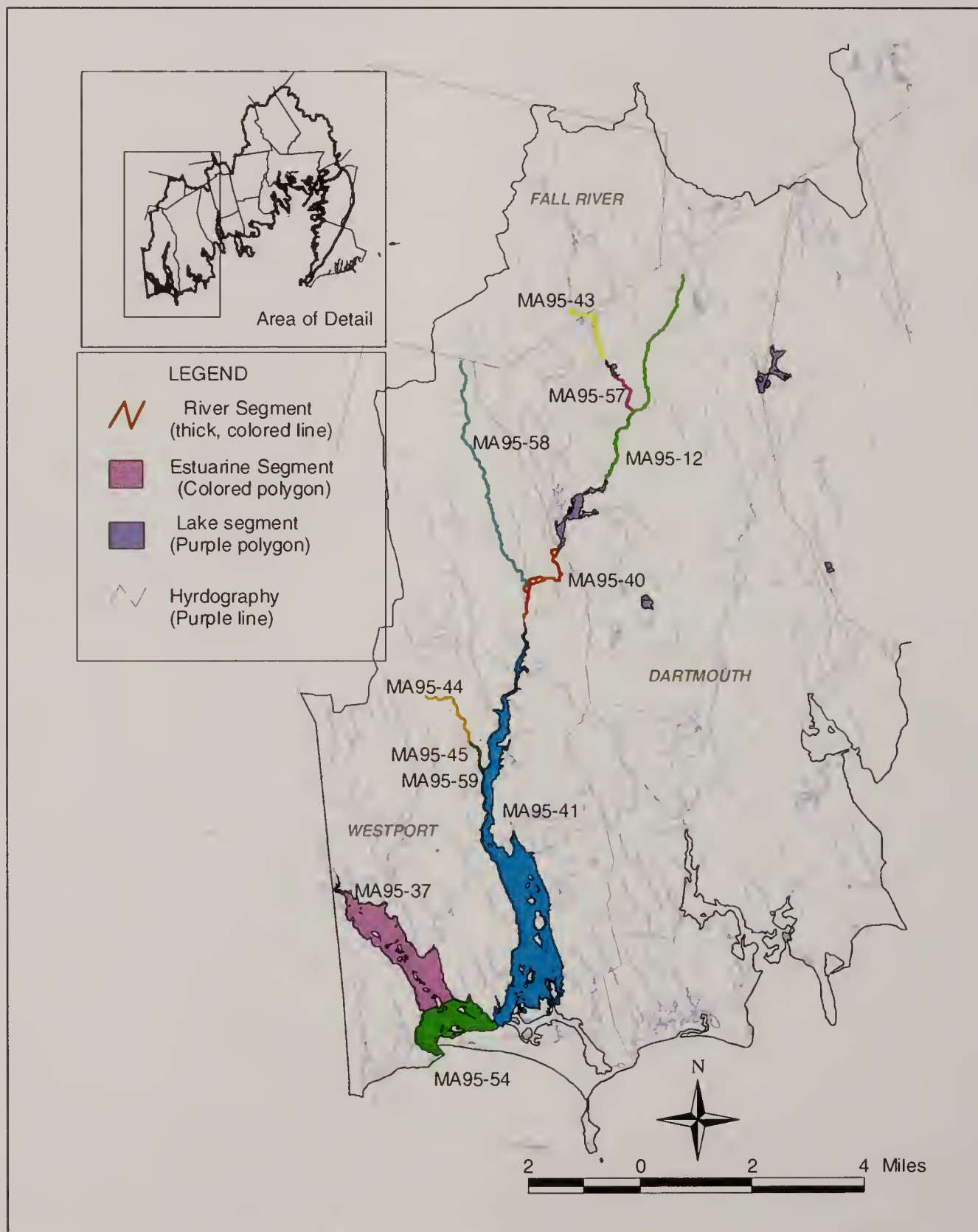
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THE WESTPORT RIVER DRAINAGE AREA

The Westport River Drainage Area is located in Westport with its headwaters in Fall River, Freetown and Dartmouth. The drainage area consists of the following 11 segments:

- Copicut River (Segment MA95-43)
- Unnamed Tributary (Segment MA95-57)
- Shingle Island River (Segment MA 95-12)
- East Branch Westport River (Segment MA95-40)
- Bread and Cheese Brook (Segment MA95-58)
- Snell Creek (Segment MA95-44)
- Snell Creek (Segment MA95-45)
- Snell Creek (Segment MA95-59)
- East Branch Westport River (Segment MA95-41)
- West Branch Westport River (Segment MA95-37)
- Westport River (Segment MA95-54).



COPICUT RIVER (SEGMENT MA95-43)

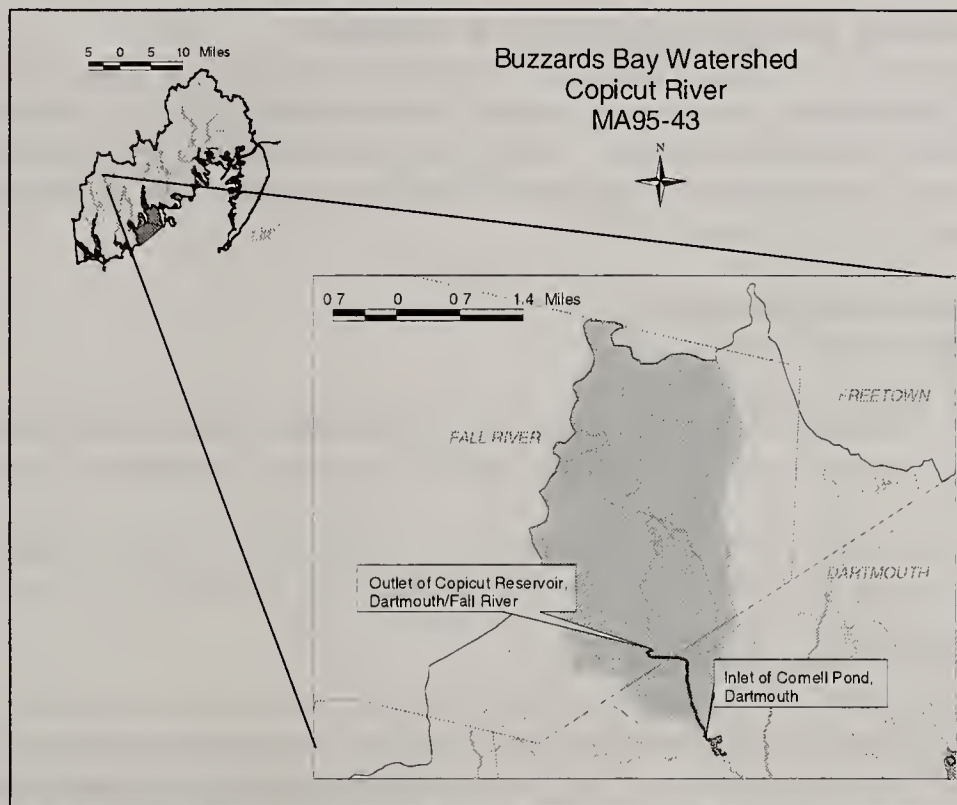
Location: Outlet of Copicut Reservoir, Dartmouth/Fall River to the inlet of Cornell Pond, Dartmouth
 Segment Length: 1.34 miles
 Classification: Class B

The drainage area of this segment is approximately 7.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-----------|-----|
| Forest | 76% |
| Wetlands | 5% |
| Open Land | 3% |

This segment is on the 1998 Massachusetts List of Waters as not meeting the water quality standards for priority organics and metals (MA DEP 1999).

The Re-Solve, Inc. Superfund Site is a former waste chemical reclamation facility situated on 6 acres of land in Dartmouth. Between 1956 and 1980, Re-Solve handled a variety of hazardous materials, including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids, and polychlorinated biphenyls (PCBs). Residues from the distillation tower, liquid sludge waste, impure solvents, and burned tires were disposed of in four on-site unlined lagoons. The lagoon contents were burned periodically to reduce the volatile organic compounds (VOCs) content. An oil waste that accumulated at the bottom of the degreaser distillation still was disposed of on one portion of the site through landfarming. This oil waste also was spread throughout the site to control dust. Cooling water from the distillation tower was discharged to a shallow on-site lagoon. The groundwater is contaminated with VOCs and PCBs. Sediments are contaminated with PCBs and VOCs and the soil contains PCBs, lead, and VOCs including, trichloroethylene (TCE), vinyl chloride, methylene chloride, and toluene. Surface water is contaminated with PCBs and VOCs. Fish from the adjacent Copicut River and Cornell Pond contain elevated levels of PCBs and mercury; mercury is not related to the site (EPA 13 December 2002b).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source S = Surface | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------------------|---------|-------------------|-------------------------|---|---|--------------------------|-------|--------|
| | | | | | | 1999 | 2000 | 2001 |
| Fall River Water Department** | 4095000 | None | 42409501 and 42409502 | Narragansett 4095000-01S & 4095000-02S Buzzards Bay 4095000-03S | Both Basins Combined= 14.59 MGD [6.37+8.22+0.1] | 6.76* | 7.72* | 10.05* |

* Applies to Buzzards Bay Number Only

**Fall River Water Department is authorized to withdraw a combined volume of 14.59 MGD/ 5325.35 MGY from a linked reservoir system that is located within two basins: the Copicut in the Buzzards Bay Watershed and the North and South Watuppa Ponds located in the Mt. Hope Basin. A single source meter is located at the point at which the water from the Copicut enters the North Watuppa Pond. A single intake is at South Watuppa Pond. When the elevation of South Watuppa falls, water flows into South Wautuppa Pond from the Copicut, therefore it is not possible, as the system is configured, to actually separate the withdrawals by basin. The assigned volumes to each basin were based on historic average use, not assigned for any reasons that were related to environmental protections. All are registered sources and compliance is measured using the total volume of 14.59 MGD, not individual basin volumes. The Water Resources Commission Interbasin Transfer (IBT) regulations do not apply to

registered sources, therefore, an IBT application is not required. Fall River has consistently operated within its total registered volume for the combined basins.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated wastewater discharges in this segment. Dartmouth and Fall River are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

Although no habitat quality and/or flow data are currently available for the Copicut River, the large water withdrawal combined with the small size of the drainage area are of concern.

The *Aquatic Life Use* is currently not assessed, however, potential effects of water withdrawals are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status.





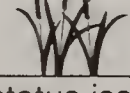
FISH CONSUMPTION

In 1988, DWM conducted fish toxics monitoring in Copicut Reservoir, Cornell Pond, and Noquochoke Lake to bracket the ReSolve Superfund site (Maietta 1989a). Based on elevated concentrations of PCBs and mercury in fish tissue MDPH issued a fish consumption advisory for the Copicut River and Cornell Pond, Dartmouth. The MDPH advisory recommends the following:

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Copicut River or Cornell Pond.
2. The general public should not consume any American eel (*Anguilla rostrata*) from Copicut River or Cornell Pond.
3. The general public should limit consumption of largemouth bass (*Micropterus salmoides*) to two meals per month.

Based on the MDPH site-specific fish consumption advisory this segment is assessed as impaired for the *Fish Consumption Use*.

Copicut River (MA95-43) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-------------------|---|--------------|---------------|---|------------------------|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED | | | |
| Fish Consumption |  | IMPAIRED | Mercury, PCBs | Contaminated sediments, CERCLA NPL (Superfund site) | Atmospheric deposition |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert status issue identified-- see details in use assessment section

RECOMMENDATIONS COPICUT RIVER (MA95-43)

- Continue to review the status of the Re-Solve Inc. Superfund site cleanup and review any environmental monitoring data and/or need for additional monitoring to assess the *Aquatic Life Use* and/or *Fish Consumption Use*.

UNNAMED TRIBUTARY (SEGMENT MA95-57)

Location: Outlet Cornell Pond, Dartmouth
to confluence with Shingle Island River,
Dartmouth

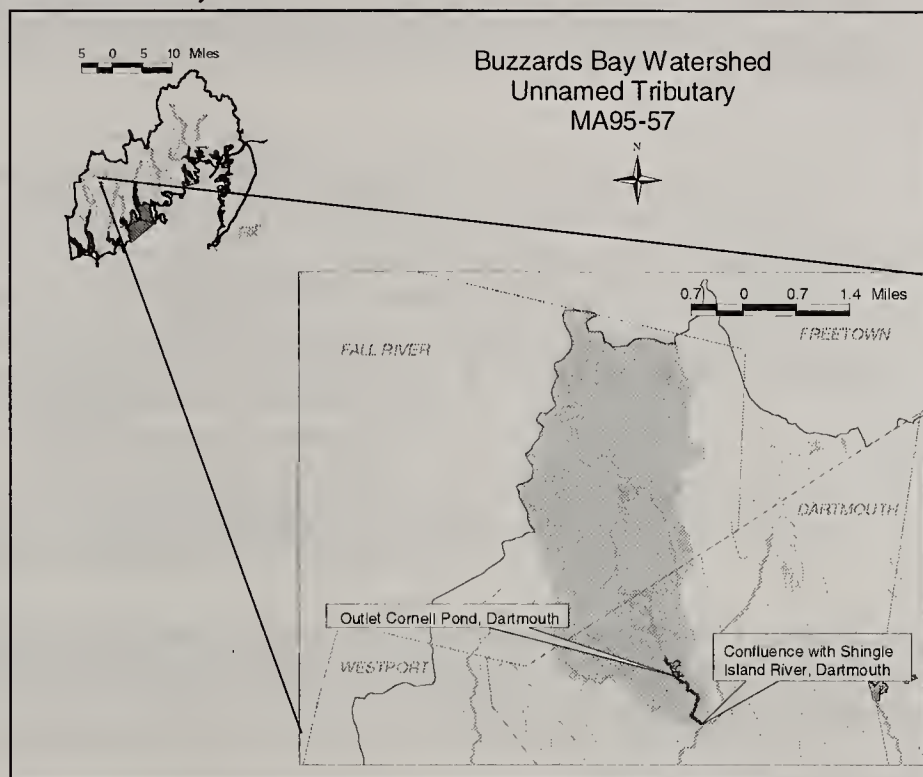
Segment Area: 1.01 miles

Classification: Class B

The drainage area of this segment is approximately 34.3 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-----------|-----|
| Forest | 91% |
| Open Land | 3% |
| Wetlands | 1% |

See details of the Re-Solve, Inc. Superfund Site, a former waste chemical reclamation facility in Copicut River segment (MA95-43).



WMA WATER WITHDRAWAL AND NPDES DISCHARGE SUMMARY

There are no regulated water withdrawals/wastewater discharges in this segment. However, it should be noted that Dartmouth and Fall River are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

A habitat assessment was conducted on this unnamed tributary as part of the Biocriteria Development Project (NB03COP) on 27 September 1996. The sampling reach received a habitat score of 145 out of 200 due to a lack of epifaunal substrate, moderate embeddedness (50-75% of the substrate surrounded by fine sediment), and moderate sediment deposition while instream flows were optimal (MA DEP 1996b).

The large water withdrawal from Copicut Reservoir (see details in Copicut River) combined with the small size of the drainage area is of concern due to the potential negative effects on instream habitat.

Biology

DWM conducted fish population sampling on this unnamed tributary downstream of Old Fall River Road, Dartmouth (Station NB03COP). Seven American eel (*Anguilla rostrata*), one yellow perch (*Perca flavescens*), four redbfin pickerel (*Esox americanus americanus*), two brown bullhead (*Ameiurus nebulosus*), one largemouth bass (*Micropterus salmoides*), and one bluegill (*Lepomis macrochirus*) were collected (MA DEP 1996b).

As part of the Biocriteria Development Project DWM conducted benthic macroinvertebrate sampling on this unnamed tributary along the same reach as fish population sampling using a modified RBP III approach (MA DEP 1996b and Nuzzo 1999). Metrics calculated for these samples were not consistent with those used for assessment purposes, therefore, details are not provided here. Please refer to *The Massachusetts Pilot Study on Numeric Biocriteria for Streams and Small Rivers 1996 Data on Macroinvertebrates* report prepared by Lotic Inc. (1998) for additional information.

Chemistry-water

Additionally, this unnamed tributary was sampled approximately 50 meters downstream of Old Fall River Road, Dartmouth as part of the Biocriteria Project on 8 October 1996. The results from Station NB03COP are:

| Parameter | Result |
|-------------------------------|--------|
| Measurement Depth (m) | 0.1i |
| Time | 12:18 |
| Temperature (°C) | 11.4 |
| pH (SU) | 6.4 |
| Conductivity (µS/cm) | 79 |
| Total Dissolved Solids (mg/L) | 50.5 |
| Dissolved Oxygen (mg/L) | 9.8 |
| Percent Saturation (%) | 89 |
| Turbidity (NTU) | 14i |

i= inaccurate readings from Hydrolab likely

The *Aquatic Life Use* is currently not assessed, however, potential effects of water withdrawals are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status. Sediment deposition and embeddedness were also noted.

FISH CONSUMPTION

In 1988 DWM conducted fish toxics monitoring in three lakes in the vicinity of the ReSolve Superfund Site: Copicut Reservoir, Cornell Pond, and Noquochoke Lake. Based on data from this survey MDPH issued a fish consumption advisory for the Copicut River and Cornell Pond, Dartmouth due to elevated levels of mercury and PCBs in fish tissue (Maietta 1989a).





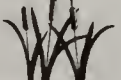
At this time a site-specific advisory for this unnamed tributary has not been issued by MDPH, therefore the *Fish Consumption Use* is currently not assessed.

AESTHETICS

During the habitat assessment survey conducted on this unnamed tributary sulfur odors, road runoff, iron deposits, foam, turbidity, abundant trash, and very soft, "mucky" substrates were noted (MA DEP 1996b).

The Aesthetics Use is not assessed, however, it is identified with an Alert Status because of the trash, foam, turbidity and odors noted during the survey conducted in the fall of 1996.

Unnamed Tributary (MA95-57) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics* |
|---|---|--|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified-- see details in use assessment sections

RECOMMENDATIONS UNNAMED TRIBUTARY (MA95-57)

- Continue to review the status of the Re-Solve Inc. Superfund site cleanup and review any environmental monitoring data and/or need for additional monitoring to assess the status of the *Aquatic Life Use*.
- In 1996 DWM identified sediment deposition (most likely from road runoff) in this unnamed tributary south of Old Fall River Road. As part of a shoreline survey, evaluate the extent of sedimentation problems in this subwatershed. Conduct biomonitoring in this subwatershed bracketing these nonpoint sources to determine if sedimentation and/or other nutrient inputs negatively effect the aquatic life. Conduct bacteria monitoring to determine if road runoff is a source of bacteria to this segment and to assess the recreational uses. As a follow up to the survey(s), determine the need to implement erosion control measures and best management practices.
- MDPH is currently reevaluating the fish consumption advisory for Copicut River/ Cornell Pond to determine if this unnamed tributary should be included. Additional fish toxics monitoring should be considered if deemed necessary.
- Work with Riverways, the Coalition for Buzzards Bay, Westport River Watershed Alliance and other concerned parties to form stream teams for the Westport River drainage area. Determine the current need to conduct a stream cleanup in this subwatershed. Review final stream team report(s) for information to assess the *Aesthetic Use*.

SHINGLE ISLAND RIVER (SEGMENT MA 95-12)

Location: Outlet of small unnamed pond north of Flag Swamp Road, Dartmouth to inlet Noquochoke Lake, Dartmouth

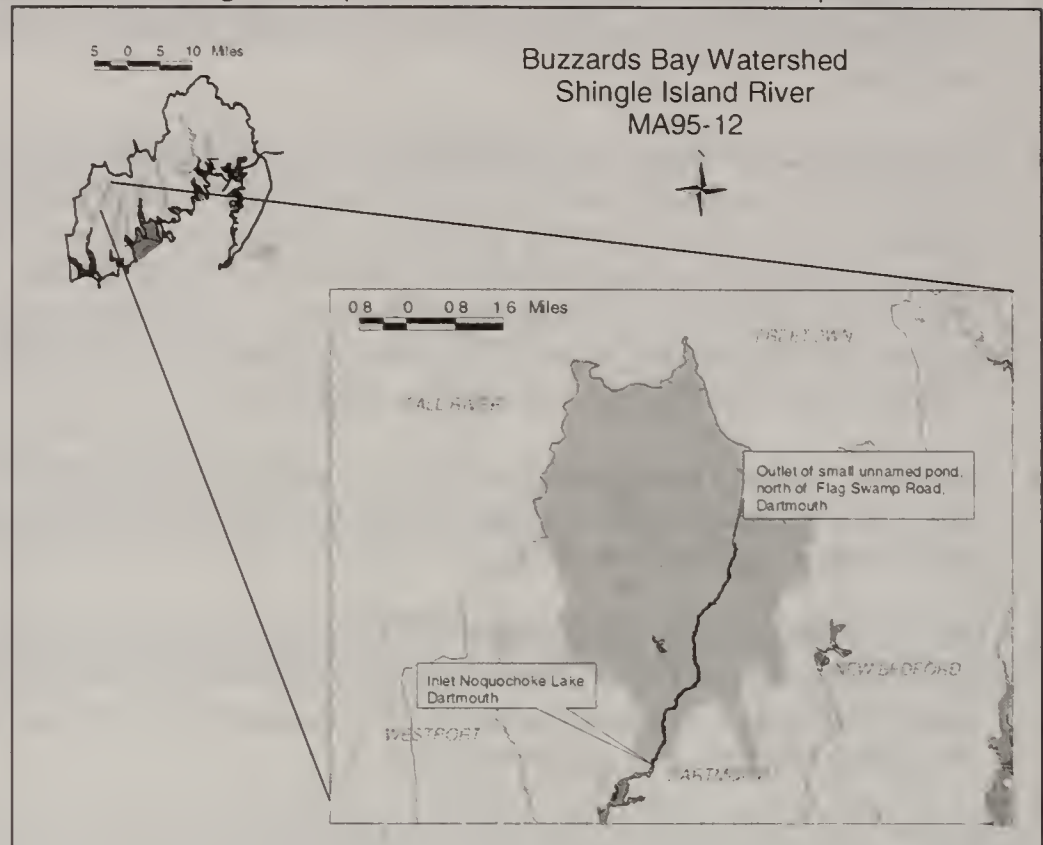
Segment Length: 5.00 miles

Classification: Class B

The drainage area of this segment is approximately 20.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 75 % |
| Residential | 8 % |
| Open Land | 5 % |

The Greater New Bedford Compost Site, a landfill owned by the Greater New Bedford Refuse District, is partially located within this subwatershed near the Dartmouth/Freetown town line (MA DEP BWP 2000).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 169,391 acres of cranberry bog open space in the Shingle Island River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 1.51 MGD (this includes the estimate of water use for the upstream segment MA95-43).

NPDES SURFACE DISCHARGE SUMMARY

Dartmouth and Fall River are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Biology

DWM conducted fish population sampling (8 October 1996) on the Shingle Island River downstream of Old Fall River Road (Station NB14SHI) in Dartmouth as part of the Biocriteria Development Project. Only two fish were collected: tessellated darter (*Etheostoma olmstedii*) and an American eel (*Anguilla rostrata*). On replicate sampling, no fish were captured, however, a single American eel was sighted. Invertebrate collection was conducted just prior to fish sampling and electrofishing was difficult due to deep, very dark, 'tea stained' water (MA DEP 1999b).

As part of the Biocriteria Development Project DWM conducted benthic macroinvertebrate sampling on the Shingle Island River along the same reach as fish population sampling using a modified RBP III approach (MA DEP 1996b and Nuzzo 1999). Metrics calculated for these samples were not consistent with those used for assessment purposes, therefore, details are not provided here. Please refer to *The Massachusetts Pilot Study on Numeric Biocriteria for Streams and Small Rivers 1996 Data on Macroinvertebrates* report prepared by Lotic Inc. (1998) for additional information.

Habitat and Flow

As part of the fish population and benthic macroinvertebrate sampling for the Biocriteria Project, DWM conducted a habitat assessment of the Shingle Island River, downstream of Old Fall River Road. There were no dams or channelization present in this reach. Substrates were comprised of sand, silt, and clay. This reach was described by DWM biologists as "classic meandering, low gradient stream

through an extensive flood plain". This stream was used as a reference station and received a habitat score of 141 out of 180 due to the lack of epifaunal substrate, sediment deposition, and lack of riffles. *Sparganium* sp. (bur-reed) was present over 40% of the reach (MA DEP 1996b).

Chemistry-water

DWM sampled the Shingle Island River at approximately 150 meters downstream of Old Fall River Road in Dartmouth (station NB14SHI) as part of the Biocriteria Development Project on 8 October 1996.

| Parameter | Result |
|-------------------------------|--------|
| Measurement Depth (m) | 0.2 |
| Time | 14:23 |
| Temperature (°C) | 10.0 |
| pH (SU) | 5.0 |
| Conductivity (µS/cm) | 60 |
| Total Dissolved Solids (mg/L) | 38.6 |
| Dissolved Oxygen (mg/L) | 9.1 |
| Percent Saturation (%) | 80 |
| Turbidity (NTU) | 7i |

i= inaccurate readings from Hydrolab likely

The *Aquatic Life Use* is currently not assessed, however, potential effects of water withdrawals (public water supply and cranberry bogs) are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status. Sediment deposition and embeddedness were also noted.

FISH CONSUMPTION






Although fish were not collected from the Shingle Island River the presence of site-specific advisories in Cornell Pond and Noquochoke Lake (Maietta 1989a) suggest that this segment should be included.

At this time a site-specific advisory for the Shingle Island River has not been issued by MDPH, therefore the *Fish Consumption Use* is currently not assessed.

AESTHETICS

As part of the fish population and benthic macroinvertebrate sampling for the Biocriteria Project, DWM conducted a habitat assessment of the Shingle Island River, downstream of Old Fall River Road (Station NB14SHI). No aesthetic quality degradation (odors, turbidity, oil, grease, etc.) was identified (MA DEP 1996b).

Shingle Island River (MA95-12) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|--|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified-- see details in the use assessment section

RECOMMENDATIONS SHINGLE ISLAND RIVER (MA95-12)

- Develop a monitoring plan to evaluate the potential impacts of water withdrawals on streamflow/habitat in this segment/subwatershed to assess the *Aquatic Life Use*.
- In 1996 DWM identified sediment deposition (most likely from road runoff) in the Shingle Island River downstream of Old Fall River Road. As part of a shoreline survey, evaluate the extent of sedimentation problems in this subwatershed. Conduct biomonitoring in this subwatershed bracketing these nonpoint sources to determine if sedimentation and/or other nutrient inputs negatively affect the aquatic life. Conduct bacteria monitoring to determine if road runoff is a source of bacteria to this segment and to assess the recreational uses. As a follow up the survey(s), determine the need to implement erosion control measures and best management practices.
- MPDH is currently reevaluating their Fish Consumption Advisory for the Shingle Island River. Additional fish toxics monitoring should be considered for this segment if deemed necessary to refine the extent of the advisory.

EAST BRANCH WESTPORT RIVER (SEGMENT MA95-40)

Location: Outlet Lake Noquochoke, Westport to Old County Road bridge, Westport

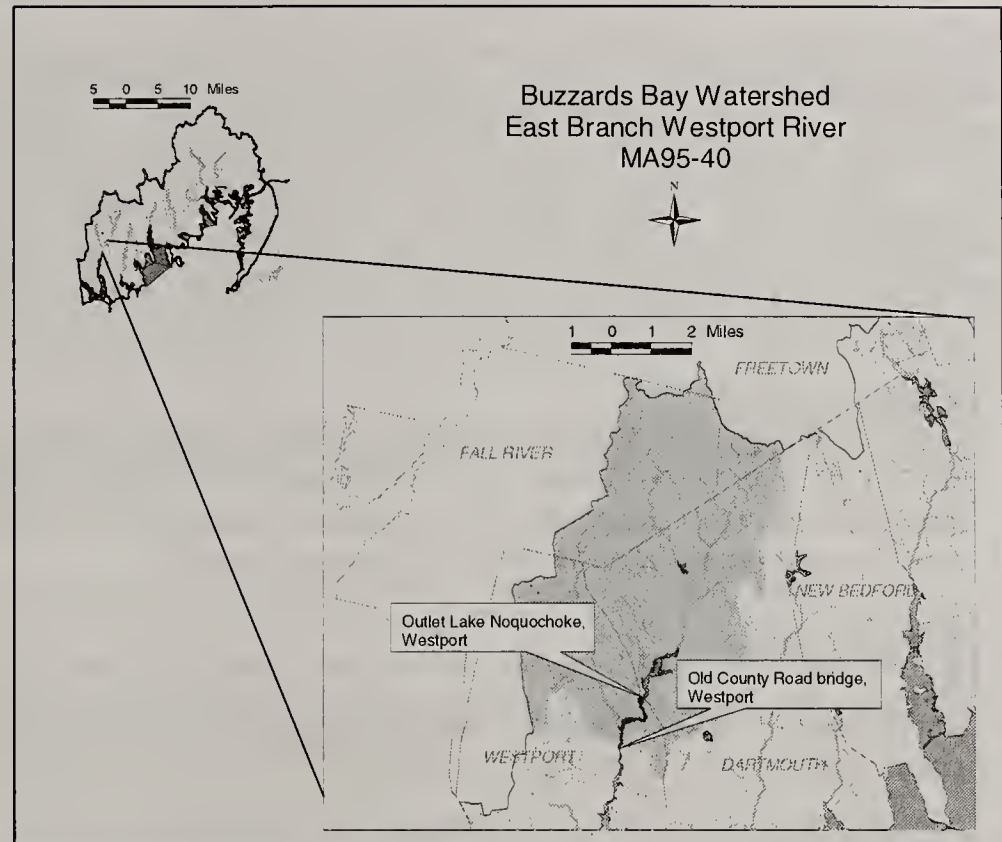
Segment Length: 2.85 miles

Classification: Class B, Warm Water Fishery

The drainage area of this segment is approximately 40.2 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 70 % |
| Residential | 14 % |
| Agriculture | 4 % |

This segment is on the 1998 Massachusetts 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|------------------------------|---------|-------------------|-------------------------|---------------------|---------------------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Dartmouth Water Department** | 4072000 | 9P242407201 | 42407202 | 4072000-04G | Registered = 1.35 Permitted = 2.11 | 3.07 | 2.97 | 2.83 |

*Excludes any authorized cranberry growers.

**Dartmouth Water Department has twelve withdrawal points in the Buzzards Bay Watershed – eleven in Segment 95-11 and one in Segment 95-40. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined.

There are 169,391 acres of cranberry bog open space in the East Branch Westport River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 1.51 mgd. This estimate includes estimated water use for the upstream segment MA95-12.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

Mid City Scrap Iron & Salvage MAR05B830

Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

The Westport River Watershed Alliance (WRWA) conducted temperature, salinity, pH, and turbidity monitoring at two stations, 3--Head of Westport River at Old Colony Road and A-1-- Westport River at Rte 177, between March and October 2001. Samples were collected during ebb or flood tide between 0600

hours and 1300 hours (Carvalho-Souza 2002 and WRWA 2001). As part of this project, ESS was commissioned to design a BMP (pocket wetland) for the stormdrain on the south side of Old Colony Road, east bank of the river.

With funding from the Massachusetts Watershed Initiative's Buzzards Bay Team, ESS conducted a bacteriological NPS assessment of the East Branch Westport River near the Head of Westport between 7 June 2001 and 30 January 2002. Sampling included storm drain sampling and instream sampling at three stations for turbidity, pH, conductivity, and flow: (upstream to downstream) WR8—East Branch, upstream of Forge Pond at 251 Reed Road; WR6—East Branch behind Primrose Lane, opposite Ferry Farm; WR3—East Branch at Head Bridge at Old Colony Road (ESS 2003). The information collected was used as support for a successful s. 319 grant awarded to the Town of Westport to address two of the major storm water discharges into the upper reaches of the river (Pierce 2003).

Habitat and Flow

As part of the bacteriological NPS assessment of the East Branch Westport River, ESS noted that the bank of the river is "coincident with a stone wall" (ESS 2003), which implies the stream has been straightened. Flow readings taken between 7 June 2001 and 30 January 2002 during the ESS assessment ranged from 11.94 to 737.64 cfs (n=18).

Chemistry-water

pH

pH reported by WRWA ranged from 4.93 to 8.18 SU with 21 of the 38 less than 6.5 SU (55%), while pH values reported by ESS ranged from 5.6 SU to 7.5 SU (n=18) with six values less than 6.5 SU.

Temperature

WRWA temperatures ranged from 1.11 to 26.67 °C. Temperatures reported by ESS ranged from 2.0°C to 23.0°C (n=18).

Turbidity

Turbidity ranged from 0.74 to 6.14 NTU (n=37). Turbidity readings reported by ESS ranged between 0.9 and 52.6 NTU (n=15), but only one measurement exceeded 25 NTU.

Salinity

Salinity ranged from 0.0 to 3.2 ppt (n=38).

Too limited data (lack of biological and DO data) are available to assess the status of the *Aquatic Life Use*; therefore, it is currently not assessed.

FISH CONSUMPTION

Although there are currently three site-specific advisories in waterbodies upstream of this segment, due to a lack of data the *Fish Consumption Use* is currently not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococci* bacteria samples at Station A-1 (Westport River at Rte 177), and Station 3 (Head of Westport River at Old Colony Road) between March and October 2001. Samples were collected during both wet and dry weather. The majority of high counts were recorded during wet weather conditions.

| Station | Fecal Coliform Bacteria Range (cfu/100mL) | Geometric Mean (cfu/100 mL) |
|--|---|---|
| A-1 (n=18, 16 during primary contact season) | 2 – 2,470 | 83.5 3 samples > 400 (19%) 1 sample > 2,000 (5%) |
| 3 (n=18, 16 during primary contact season) | 25 - 84,000 | 375 (7 greater than 400 – 44%) (4 greater than 2,000 – 22%) |






Enterococci counts ranged between 2 and 201,000 cfu/200mL (n=35). Twenty-six of the 35 samples (74%) had counts greater than 61 cfu/100mL and six counts were greater than 1,000 cfu/100mL, primarily collected during wet weather conditions (Carvalho-Souza 2002).

ESS collected fecal coliform bacteria samples from their three water quality stations on this segment of the East Branch Westport River as part of a NPS bacteriological assessment project (01-02/MWI). Samples were collected on 7 June, 21 September, 20 November, and 17 December 2001, and 4 and 30 January 2002 during wet and dry weather. Results from the first two sampling rounds were censored due to lab error. None of the samples exceeded 46 cfu/100 mls (ESS 2003). Additionally, three storm drains were also sampled. Sampling from the storm drains suggested that station WR5 at Gifford Road, between Rte 177 and Old Colony Road, may be a significant source of fecal coliform bacteria during wet weather (counts were 580,000 and 2,100,000 cfu/100mL; n=2). Station WR5 is immediately downstream from the Ferry Farm. The area has three small detention/infiltration basins, however, they do not appear to be designed properly. ESS recommended that the downgradient side of the system be constructed or reinforced with a water impermeable material, as well as implement vigorous behavioral BMPs at the farm.

The Town of Westport was awarded a s. 319 grant for a storm water mitigation project in 2002. The project will install two BMPs at storm water drains (one near a farm on Gifford Road and one near Head of Westport) in order to treat the first flush using sediment collection and effluent infiltration. Pre- and post implementation water quality monitoring will be conducted. The project is expected to take 2½ years to complete. QAPP development began in January 2003 (Peirce 2003).

Based on the elevated fecal coliform bacteria counts during wet weather conditions documented by WRWA, the *Primary Contact Recreational Use* is assessed as impaired. The *Secondary Contact Recreational Use* is assessed as support in the upper 2.53 miles and impaired downstream from the Gifford Road storm drain (lower 0.32 miles).

East Branch Westport River (MA95-40) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-------------------|---|-------------------------------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Primary Contact |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems, highway/road runoff, Animal feeding operations |
| Secondary Contact |  | 2.53 mi SUPPORT 0.32 mi IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems, highway/road runoff, Animal feeding operations |
| Aesthetics |  | NOT ASSESSED | | | |

RECOMMENDATIONS EAST BRANCH WESTPORT RIVER (MA95-40)

- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and implementation of BMPs to assess the recreational uses.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.
- Additional fish toxics monitoring should be conducted downstream of Noquochoke Lake in the East Branch Westport River and Forge Pond to help assess the *Fish Consumption Use*.

BREAD AND CHEESE BROOK (SEGMENT MA95-58)

Location: Headwaters north of Old Bedford Road, Westport to confluence with the East Branch Westport River, Westport

Segment Length: 4.94 miles

Classification: Class B

The drainage area of this segment is approximately 10.6 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 67% |
| Residential | 20% |
| Agriculture | 5% |

MassWildlife has proposed that Bread and Cheese Brook be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or NPDES discharges in this subwatershed. It should be noted, however, that Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

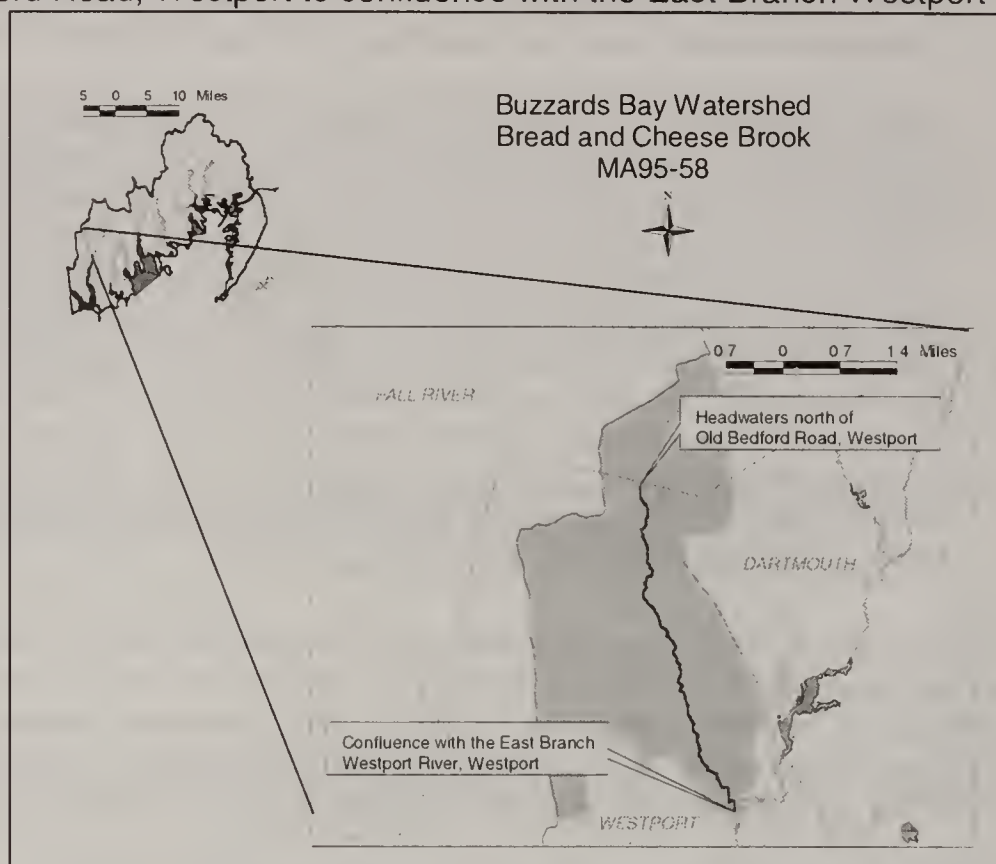
Biology

DWM conducted fish population sampling (8 October 1996) on Bread and Cheese Brook approximately 300 meters downstream from Route 177 (station NB04BAC) in Westport as part of the Biocriteria Development Project. Seven American eel (*Anguilla rostrata*), one swamp darter (*Etheostoma fusiforme*), one creek chubsucker (*Erimyzon oblongus*), two brook trout (*Salvelinus fontinalis*), and one chain pickerel (*Esox niger*) were collected (MA DEP 1996b).

Also as part of the Biocriteria Development Project DWM conducted benthic macroinvertebrate sampling on Bread and Cheese Brook along the same reach as fish population sampling using a modified RBP III approach (MA DEP 1996b and Nuzzo 1999). Metrics calculated for these samples were not consistent with those used for assessment purposes, therefore, details are not provided here. Please refer to *The Massachusetts Pilot Study on Numeric Biocriteria for Streams and Small Rivers 1996 Data on Macroinvertebrates* report prepared by Lotic Inc. (1998) for additional information.

Habitat and Flow

As part of the fish population and benthic macroinvertebrate sampling for the Biocriteria Project, DWM conducted a habitat assessment of Bread and Cheese Brook approximately 300 meters downstream from Route 177 (station NB04BAC). There were no dams or channelization present in this reach. Substrates were comprised of cobble, gravel, and sand. This stream was used as a reference station and received a habitat score of 166 out of 200 due to the lack of epifaunal substrate, moderate sediment deposition, limited riffle areas, and human activities impacting the riparian zone. *Sparganium* sp. (bur-reed) was present over 30% of the reach (MA DEP 1996b).



Chemistry - water

DWM sampled Bread and Cheese Brook approximately 300 meters downstream of Route 177 in Westport (station NB04BAC) as part of the Biocriteria Development Project on 8 October 1996.

| Parameter | Result |
|-------------------------------|--------|
| Measurement Depth (m) | **i |
| Time | 16:12 |
| Temperature (°C) | 10.3 |
| pH (SU) | 5.4 |
| Conductivity (µS/cm) | 166 |
| Total Dissolved Solids (mg/L) | 106 |
| Dissolved Oxygen (mg/L) | 10.8 |
| Percent Saturation (%) | 96 |
| Turbidity (NTU) | 6i |

** = censored or missing data

i = inaccurate readings from Hydrolab likely

Too little current data are available; therefore, the *Aquatic Life Use* is currently not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION





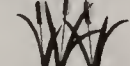
WRWA collected bacteria samples from Bread and Cheese Brook at Rte 177 between March and October 2001. Fecal coliform bacteria counts ranged from 0 to 1,190 cfu/100mL (n=17). The geometric mean of the samples collected during the primary contact season was 55.9. Two of the 15 samples (13%) collected during the primary contact season had counts greater than 400 cfu/100mL. Both of the elevated counts were representative of wet weather conditions. *Enterococci* counts at Rte 177 ranged from 0 to 4940 cfu/100ml (n=16).

ESS also collected fecal coliform bacteria samples from the three stations along Bread and Cheese Brook as part of a NPS bacteriological assessment project (01-02/MWI); station WR13 was located at Bedford Road, WR12 was located at Route 6 and WR10 was located at Route 177. Samples were also collected from one unnamed tributary at Gifford Road (station WR11) and a storm drain on the downstream side of station WR13. Samples were collected on 7 June, 21 September, 20 November, and 17 December 2001, and 4 and 30 January 2002 during wet and dry weather. Results from the first two sampling rounds were censored due to lab error. None of the fecal coliform counts exceeded 100 cfu/100 mls (ESS 2003).

ESS noted that large impervious areas along Route 6 and Gifford Road convey storm water runoff directly into Bread and Cheese Brook. Livestock pastures were also noted within 200 feet of the brook.

Based on the elevated fecal coliform bacteria counts during wet weather conditions documented by WRWA, the *Primary Contact Recreational use* is assessed as impaired. The *Secondary Contact Recreational Use*, however, is assessed as support.

Bread and Cheese Brook (MA95-58) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-------------------|---|--------------|-------------------------|---------|---|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Primary Contact |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems, grazing in riparian zone, highway/road runoff |
| Secondary Contact |  | SUPPORT | | | |
| Aesthetics |  | NOT ASSESSED | | | |

RECOMMENDATIONS BREAD AND CHEESE BROOK (MA95-58)

- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and implementation of BMPs to assess the recreational uses.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.
- In 1996 DWM identified sediment deposition (most likely from road runoff) in Bread and Cheese Brook downstream of Route 177. As part of a shoreline survey, evaluate the extent of sedimentation problems in this subwatershed. Conduct biomonitoring in this subwatershed bracketing these nonpoint sources to determine if sedimentation and or other nutrient inputs negatively affect the aquatic life. Conduct bacteria monitoring to determine if road runoff is a source of bacteria to this segment and to assess the recreational uses. As a follow up to the survey(s), determine the need to implement erosion control measures and best management practices.

SNELL CREEK (SEGMENT MA95-44)

Location: Headwaters west of Main Street, Westport to Drift Road, Westport

Segment Length: 1.49 miles

Classification: Class B

The drainage area of this segment is approximately 0.5 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 72 % |
| Agriculture | 16 % |
| Residential | 9 % |

MassWildlife has proposed that this segment, as well as an unnamed tributary (locally known as Snell Creek) be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are no known regulated water withdrawals or surface discharges in this segment.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

Thad's Auto Salvage MAR05B708

The Town of Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Chemistry-water

WRWA conducted temperature, salinity, pH, and, turbidity monitoring at one station, S-1 Snell Creek at Drift Road, between March and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002).

pH

pH in Snell Creek ranged from 6.02 to 7.16 S.U. (n=18).

Temperature

Temperature in Snell Creek ranged from 0 to 21.39 °C with three of the 17 measurements (18%) greater than 20°C.

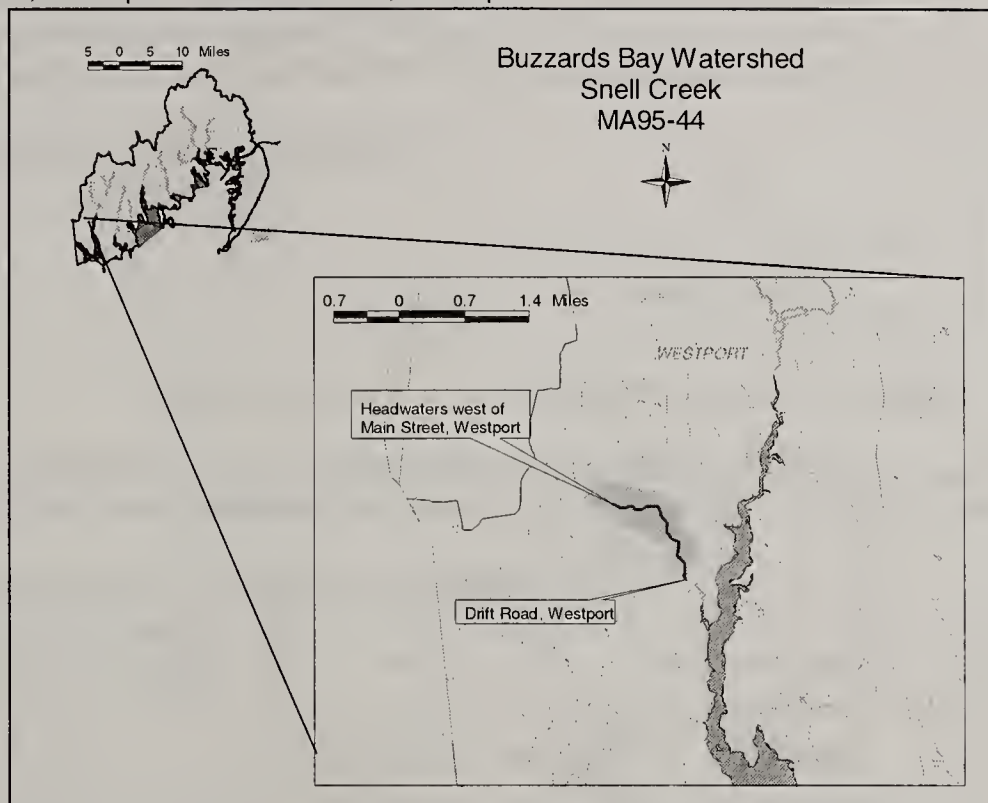
Turbidity

Turbidity ranged from 0.40 to 4.01 NTU (n=18).

Salinity

Salinity measurements in Snell Creek were all 0.1 ppt (n=18).

Too limited data (lack of biological and DO data) are available; therefore, the *Aquatic Life Use* is currently not assessed.



PRIMARY AND SECONDARY CONTACT RECREATION






WRWA collected fecal coliform and *Enterococci* bacteria samples at Station S-1, Snell Creek at Drift Road between March and October 2001. Samples were collected during both wet and dry weather. The majority of exceedances were recorded during wet weather conditions (Carvalho-Souza 2002).

| Station | Fecal Coliform Bacteria Range (cfu/100mL) | Geometric Mean |
|--|--|---|
| S-1 (n=20, 17 during primary contact season) | 6 – 3,100 | 92.11 6 samples > 400 (35%) 2 samples > 2,000 (10%) |

Enterococci counts ranged from 2 to 37,000 cfu/100mL.

Based on the elevated fecal coliform bacteria counts, the *Primary Contact Recreational Use* is assessed as impaired and the *Secondary Contact Recreational Use* is assessed as support.

Snell Creek (MA95-44) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-------------------|---|--------------|-------------------------|---------|---|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Primary Contact |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |
| Secondary Contact |  | SUPPORT | | | |
| Aesthetics |  | NOT ASSESSED | | | |

RECOMMENDATIONS SNELL CREEK (MA95-44)

- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs to assess the recreational uses.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the status of the *Aquatic Life Use* and the recreational uses.

SNELL CREEK (SEGMENT MA95-45)

Location: Drift Road, Westport to Marcus' Bridge, Westport

Segment Length: 0.67 miles

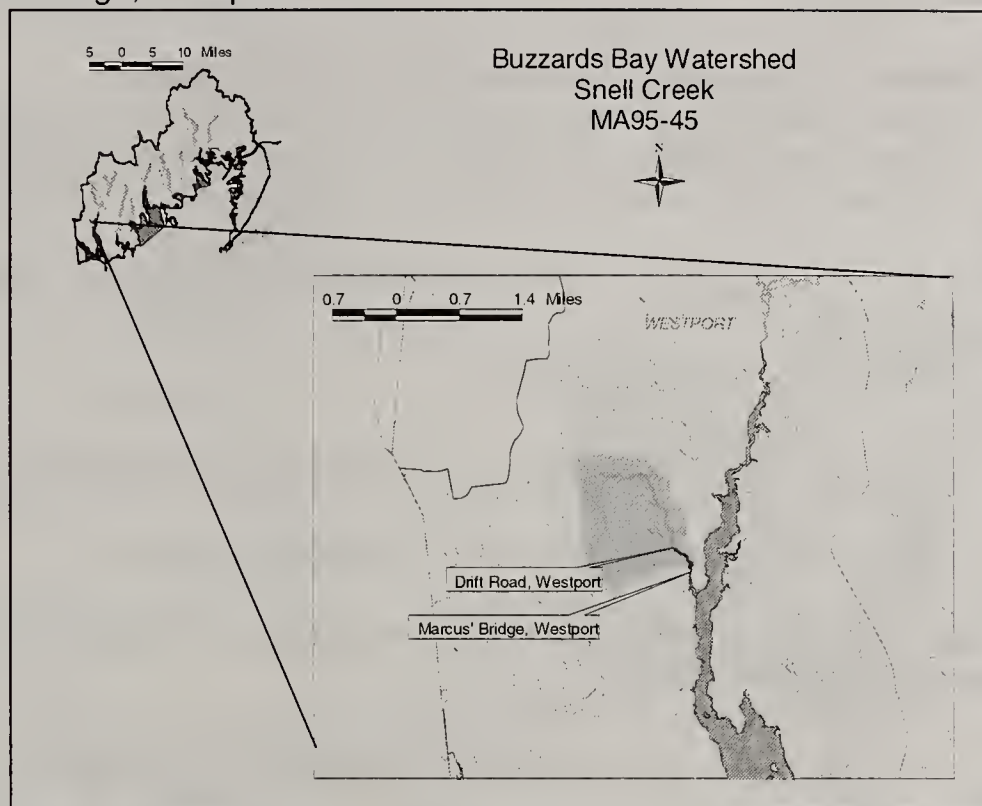
Classification: Class B

The drainage area of this segment is approximately 1.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 65 % |
| Agriculture | 16 % |
| Residential | 16 % |

This segment is on the 1998 Massachusetts 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

MassWildlife has proposed that this segment, as well as an unnamed tributary (locally known as Snell Creek), be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are no known regulated water withdrawals in this subwatershed.

NPDES SURFACE DISCHARGE SUMMARY

Jose Pimental (MA0040100), EPA Region 1 issued the first *Concentrated Animal Feeding Operations* (CAFO) permit under the NPDES regulations to the 30-acre farm on Drift Road that borders both Snell Creek and the East Branch of the Westport River (segment MA95-40). The CAFO permit requires specific best management practices be used for manure and milk parlor waste to ensure no discharge to the waterbodies. In addition a vegetated buffer of up to 100 feet must be maintained between the pastures and Snell Creek and between the East Branch of the Westport River and the farm.

The Town of Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Chemistry-water

WRWA conducted temperature, salinity, pH, and turbidity monitoring at one station S-7 Snell Creek at Marcus' Bridge, between March and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002).

pH

pH in Snell Creek ranged from 6.13 to 7.16 S.U. (n=18).

Temperature

Temperature in Snell Creek ranged from 0 to 22.22 °C with three of the 17 measurements (18%) greater than 20°C.

Turbidity

Turbidity ranged from 0.47 to 4.69 NTU (n=18).

Too limited data (lack of biological and DO data) are available; therefore, the *Aquatic Life Use* is currently not assessed.

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococci* bacteria samples at Station S-7 Snell Creek at Marcus' Bridge between March and October 2001. Samples were collected during both wet and dry weather. The majority of exceedances were recorded during wet weather conditions (Carvalho-Souza 2002).



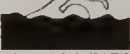

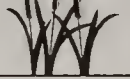
| Station | Fecal Coliform Bacteria Range (cfu/100mL) | Geometric Mean |
|---|---|--|
| S-7* (n=17, 16 during primary contact season) | 17 – 6,000 | 307.16 7 samples > 400 (44%) 4 samples > 2,000 (24%) |

*Value reported as zero was not used in the reported range or calculation

Enterococci counts ranged from 12 to 94,000 cfu/100mL.

Based on the high fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational uses* are assessed as impaired.

Snell Creek (MA95-45) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-------------------|---|--------------|-------------------------|--|---|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Primary Contact |  | IMPAIRED | Fecal coliform bacteria | Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area | Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |
| Secondary Contact |  | IMPAIRED | Fecal coliform bacteria | Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area | Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |
| Aesthetics |  | NOT ASSESSED | | | |

RECOMMENDATIONS SNELL CREEK (MA95-45)

- Continue to monitor farm operation (effectiveness of best management practices) and compliance with CAFO permit requirements that are aimed at reducing bacteria and nutrient inputs to Snell Creek.
- Develop a monitoring program to bracket nonpoint sources of bacteria to Snell Creek and to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, implementation of best management practices, implementation of vegetated buffer zone between the farm and Snell Creek, and the Phase II community storm water management programs. Data from the program could be used to assess the recreational uses.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and recreational uses.

SNELL CREEK (SEGMENT MA95-59)

Location: Marcus' Bridge, Westport to confluence with the East Branch Westport River, Westport

Segment Area: 0.01 square miles

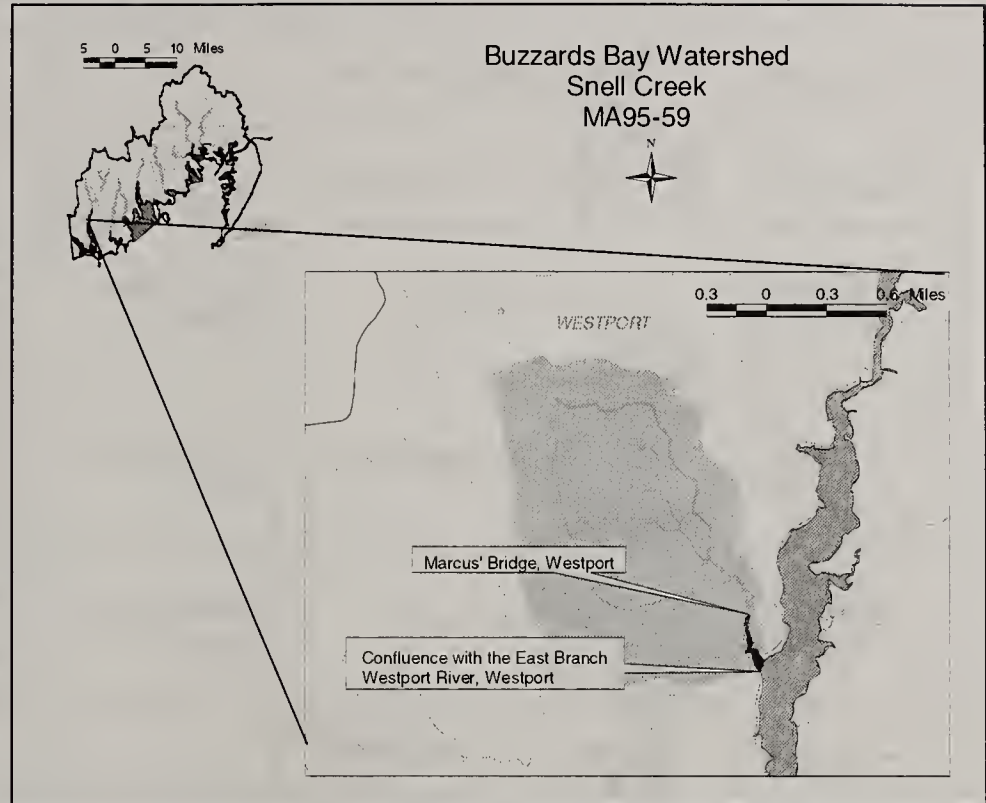
Classification: Class SA

The drainage area of this segment is approximately 1.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 63 % |
| Agriculture | 18 % |
| Residential | 14 % |

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no known regulated water withdrawals or NPDES discharges along this segment. It should be noted, however, that Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).



USE ASSESSMENT

SHELLFISH HARVESTING






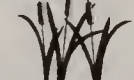
The DMF Shellfish Status Report of July 2000 indicates that growing area BB4.2, which includes this entire segment, is restricted (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

As a result of elevated fecal coliform bacteria counts documented by WRWA at Marcus' Bridge and the known problems at the Pimental Farm (see segment MA95-45) both the recreational uses are assessed as impaired.

Snell Creek (MA95-59) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|----------------------|--|--------------|-------------------------|--|---|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting |  | IMPAIRED | Fecal coliform bacteria | Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area | Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |
| Primary Contact |  | IMPAIRED | Fecal coliform bacteria | Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area | Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |
| Secondary Contact |  | IMPAIRED | Fecal coliform bacteria | Animal feeding operation, grazing in riparian zone, dairy outside milk parlor area | Municipal separate storm sewer systems, on-site septic systems, highway/road runoff |
| Aesthetics |  | NOT ASSESSED | | | |

RECOMMENDATIONS SNELL CREEK (MA95-59)

- Develop a monitoring program for bacteria to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, compliance with CAFO permit, and the Phase II community storm water management programs and to continue to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports (sanitary surveys and triennial reports) to reduce bacteria and remediate sources causing the closure of the shellfish beds. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.

EAST BRANCH WESTPORT RIVER (SEGMENT MA95-41)

Location: Old County Road bridge, Westport to the mouth at Westport Harbor, Westport (excluding Horseneck Channel)

Segment Area: 2.65 square miles

Classification: Class SB, Shellfishing (Restricted)

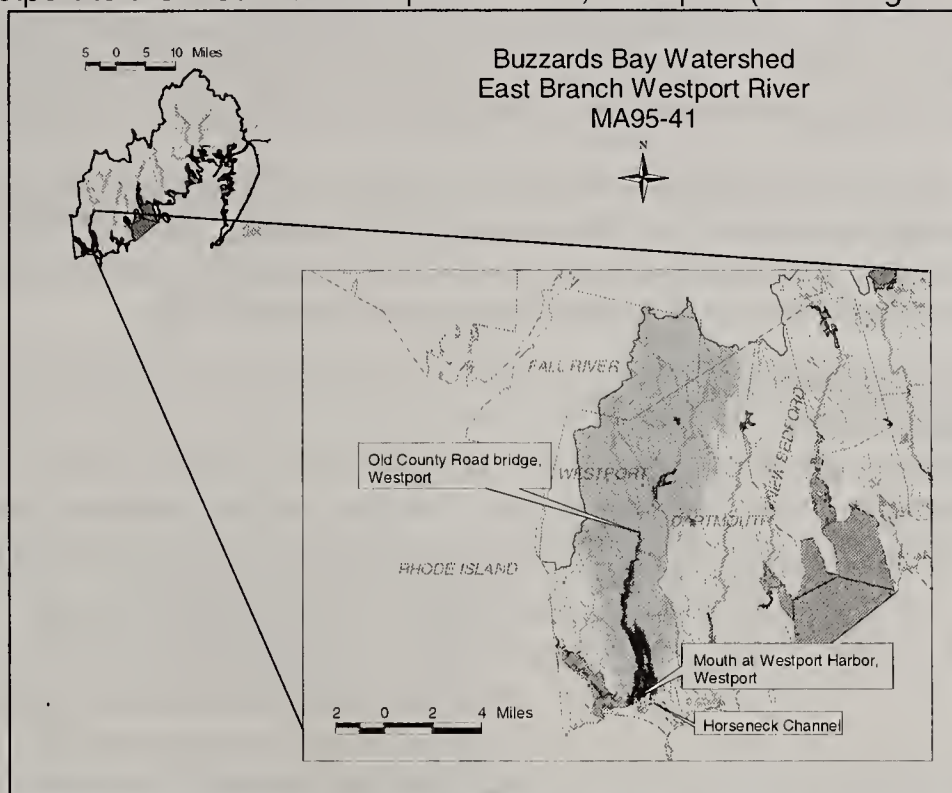
The drainage area of this segment is approximately 58.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 66 % |
| Residential | 14 % |
| Agriculture | 9 % |

MassWildlife has proposed that Kirby Brook, a tributary to this segment, be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

There is public access to the

Westport River via one asphalt boat launch maintained by the Department of Environmental Management Forest and Parks Division. There are 35 parking spaces at this location (DFWELE 2002). There are two vessel sewage pump-out boats at the Westport Point-Town Dock (BBP undated and DMF 29 January 2003).



The Coalition for Buzzards Bay conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at seven stations on this segment of the East Branch Westport River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at six stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Coalition states that the system is currently experiencing “nutrient related habitat decline” as supported by the disappearance of eelgrass beds in the upper estuary and elevated total nitrogen and chlorophyll *a* concentrations, high phytoplankton biomass, low Secchi depths, and frequent oxygen depletion (defined by CBB as <60% saturation). While eelgrass beds are still present in the lower third to half of the region, they have been reduced from historic levels throughout the estuary. This estuary sustains the largest breeding population of osprey and is one of fifteen heron rookeries in Massachusetts. The Coalition divides this segment into three areas, the upper east branch, mid east branch, and outer east branch (Howes *et al* 1999). The 1997-2001 average Health Index Score for the upper east branch was 18.1 (poor), the mid east branch score was 30.6 (poor), and the outer east branch score was 63.4 (fair) (CBB undated b). Sources of nitrogen loading identified by the Coalition include residential and commercial land development, crop and animal agriculture, and onsite septic systems. Dairy cows may contribute to fecal coliform bacteria loading.

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 169,391 acres of cranberry bog open space in the East Branch Westport River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 1.51 MGD. This estimate includes the estimates of water use for the upstream segments MA95-40 and MA95-45.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

F L Tripp & Sons Inc MAR05C082

Jose Pimental (MA0040100). EPA Region 1 issued the first *Confined Animal Feeding Operation* (CAFO) permit under the NPDES regulations to a 30-acre farm on Drift Road that borders both the East Branch of the Westport River and Snell Creek (segment MA95-45). The CAFO permit requires the size of the dairy herd be permanently reduced and specific best management practices used for manure and milk parlor waste. In addition, a vegetated buffer of up to 100 feet must be maintained between the pastures and Snell Creek and between the East Branch of the Westport River and the farm.

The Town of Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

WRWA conducted temperature, salinity, pH, and turbidity monitoring between March and October 2001 at six stations on this segment and one tributary station. Samples were collected during ebb or flood tide between 0600 and 1300 at the following stations (Carvalho-Souza 2002):

- 14-River off Cummings Lane
- 15-River off of Cadaman's Neck
- 17-River at Doctor's Point
- 18-River at the Mouth of Snell Creek
- 19-River off of Farm North Wall
- KB-River at the Mouth of Kirby Brook
- K4-Kirby Brook at Drift Road

As part of the Coastal 2000 Project, CZM, in partnership with EPA, UMass Boston, and UMass Dartmouth, sampled two stations on the East Branch Westport River-- 39A (near Lower Spectacle Island) and 35B (near Little Ram Island). Sediment toxicity; sediment chemistry; *in situ* DO, temperature, salinity, pH; TSS; chlorophyll *a*; and ammonia samples were collected on 13 September 2000. Sediments were analyzed for 78 analytes and TOC. Benthic community structure and habitat assessments were also conducted, however, final metrics have not yet been calculated. Additional monitoring was conducted in 2001 and results are not yet available (Krahforst 2003).

Habitat and Flow

The Hix Bridge on Bridge Road causes a tidal restriction due to build up of sediments under the bridge (BBP Tidal Atlas Site WP06). Additionally, large granite blocks, which toppled into the river during the Hurricane of 1938, also impede flows. The ACOE conducted a tidal flushing study to determine the benefits of increased tidal flushing (BBP 2002b). The Massachusetts Highway Department reconstruction of the Hix Bridge during the spring of 2003 will improve the storm water drainage facilities on both sides of the river. The drainage from this bridge, at a low point in the road, will now be collected in basins and diverted into a vegetated swale (Janik 2003).

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the East Branch Westport River from historic 1951 black and white aerial photography. Eelgrass beds in the East Branch Westport River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Decline of eelgrass beds occurred in the areas to the northwest of Upper and Lower Spectacle Island, to the northeast of Big Pine Island, south of Big Pine Island and west of Great Island, east of Great Island and Cunning Island, and east of Wood Point.

Toxicity-sediment

As part of the Coastal 2000 Project (Krahforst 2003) sediment toxicity tests were conducted on sediments from Station 39A and 35B in the East Branch Westport River using the small shrimp-like amphipod *Ampelisca abdita*. (*Ampelisca* construct tubes of fine sand grains and feed on detritus and are especially sensitive to oil pollution). Amphipods were exposed to sediments for 10 days under static conditions following the EPA Environmental Monitoring and Assessment Program (EMAP) procedures (EPA 1995 and ASTM 1991). Twenty juvenile amphipods were added to each test chamber for a ten-

day exposure. The surviving amphipods were counted, and the results reported as the average number of amphipods surviving in the sample tests divided by the number of amphipods surviving in the control sediment, expressed as a percent. Lower values of this result indicate higher toxicity. The result was considered to be statistically significant if sample and control values were distinct with a p-value ≤ 0.05 in a one way analysis of variance (ANOVA) F test. The assay was taken to indicate toxicity if the survival rate was less than 80% of the control and the test was statistically significant. Sediments from Station 39A were not toxic (survival $>80\%$). Sediments at 35B, however, were acutely toxic (74.74% mean survival when compared to control survival).

Chemistry-water

DO

The dissolved oxygen concentration measured by Coastal 2000 on 13 September 2000 at Station 35B was 7.32 mg/L (surface) and 6.06 mg/L (bottom). The DO concentration at Station 39A was 5.52 mg/L (surface) and 5.56 mg/L (bottom).

pH

WRWA reported pH ranging from 6.02 to 8.15 SU. Six of the 103 readings from throughout their sampling area were less than 6.5 SU (6%). pH at the tributary station ranged from 5.68 to 7.09 SU (n=22). pH taken as part of the Coastal 2000 Project was 8.04 SU at station 39A, near Lower Spectacle Island, and 8.11 SU at station 35B, near Little Ram Island.

Temperature

WRWA reported temperatures ranging from 8.33 to 28.06°C (n=107). Temperatures in the tributary did not exceed surface water quality standards. The surface water temperature at CZM Station 35B was 21.74°C and the bottom temperature was 21.78°C. At CZM Station 39A, the surface temperature was 22.67°C and in the bottom waters the temperature was 21.85°C.

Turbidity

Turbidity at the WRWA stations ranged from 1.62 to 6.93 NTU (n=104). Turbidity in the tributary ranged from 0.53 to 3.53 NTU (n=22).

Salinity

Salinities at the WRWA stations ranged from 0.1 to 30.2 ppt (n=104). Salinity in the tributary ranged from 0.0 to 0.2 ppt (n=19). Salinity at CZM Station 35B was 31.03 at the surface and 30.96 in the bottom water. At Station 39A, salinity was 28.99 (surface) and 30.75 (bottom).

Total Suspended Solids

TSS measured as part of the Coastal 2000 Project at Station 39A was 3.53 mg/L. At Station 35B TSS in the surface waters was 4.03 mg/L and 3.74 mg/L in the bottom waters.

Ammonia- Nitrogen (as N)

The ammonia concentration at station 39A was 0.032 mg/L and at Station 35B, the ammonia concentration was 0.03 mg/L (n=2). Neither of these values exceeded the criteria continuous concentration (chronic criteria) for ammonia-nitrogen.

Chlorophyll a

The chlorophyll a concentration at Station 39A was 1.41 µg/L and at Station 35B the concentration was 1.75 µg/L.

Because of the loss of eelgrass bed habitat, the *Aquatic Life Use* is assessed as impaired for this segment of the East Branch Westport River. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources (animal feeding operation and storm drains) or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include septic systems. Habitat alteration (tidal restriction) in the form of sedimentation at the Hix bridge is also a concern.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB3.0, BB3.13, BB4.0, BB4.24 are approved; BB4.13 and BB4.20, BB4.7, BB4.8, BB4.9 are conditionally approved; BB4.1, BB4.5, BB4.6, and BB4.11 are prohibited; and BB4.2 is restricted (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 2.01 mi² and impaired for 0.64mi².

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococcus* bacteria samples at their water quality stations between March and October 2001 (Carvalho-Souza 2002).

| Station | Fecal Coliform Bacteria Range (cfu/100mL) | Geometric Mean (cfu/100mL) |
|---|---|--|
| 14 (n=23; 20 samples collected during primary contact season) | 2 - 2,900 | 30.56 (3 greater than 400-14%) (1 greater than 2,000- 4%) |
| 15 (n=20; 18 samples collected during primary contact season) | 1 - 9,200 | 30.54 (4 greater than 400- 22%) (3 greater than 2,000- 15%) |
| 17 (n=15, 14 samples collected during primary contact season) | 6 - 25,000 | 89.70 (4 greater than 400- 29%) (2 greater than 2,000- 13%) |
| 18 (n=15, 13 samples collected during primary contact season) | 6 - 30,600 | 321.93 (4 greater than 2000- 27%) |
| 19 (n=15, 15 samples collected during primary contact season) | 10 - 29,900 | 291.71 (4 greater than 2,000 – 27%) |
| KB (n=11, 10 samples collected during primary contact season) | 56 - 31,800 | 422.85 (2 greater than 2,000- 18%) |
| K4 (n=20, 18 samples collected during primary contact season) | 14 - 2,500 | 87.02 (2 greater than 400 – 11%) (1 greater than 2,000 – 5%) |







Enterococci counts ranged from 0 to 49,400 cfu/100mL (n=83). *Enterococci* counts at the tributary station ranged from 3 to 13,500 cfu/100mL (n=17) (Carvalho-Souza 2002).

ESS conducted a bacteriological NPS assessment project (01-02/MWI) of the East Branch Westport River. In-stream sampling occurred in the upstream segment of the river. One wet weather storm drain sample was collected from station WR4 on 17 December 2001; the fecal coliform bacteria count was 60 cfu/100mL. There are three additional storm drains that discharge untreated storm water to the East Branch Westport River downstream of Head Bridge/Old Colony Road (ESS 2003). Fecal coliform bacteria at station WR1 (storm drain along west side of Head Bridge at Old Colony Road) ranged from 1 to 700 (n=3). At station WR2 (storm drain along east side of Head Bridge at Old colony Road) fecal coliform bacteria counts were 610 and 1,600 cfu/100mL (n=2). Sampling from the storm drains indicated that station WR5 at Gifford Road, between Old Colony Road and Rte 177 (upstream of this segment), was a significant source of fecal coliform bacteria during wet weather (counts were 580,000 and 2,100,000 cfu/100mL; n=2). Fecal coliform bacteria at station WR1 ranged from 1 to 700 (n=3) and at station WR2 fecal coliform bacteria counts were 610 and 1,600 cfu/100mL. Station WR5 is immediately downstream from the Ferry Farm. The area has three small detention/infiltration basins, however, it does not appear to be designed properly. ESS recommended that the downgradient side of the system be reconstructed or reinforced with a water impermeable material and that vigorous behavioral BMPs be implemented at the farm.

The Town of Westport was awarded a s. 319 grant for a storm water mitigation project in 2002. The project will install two BMPs; one a pocket wetland at station WR2 and the other at the farm on Gifford Road to treat the first flush using sediment collection and effluent infiltration. Pre- and post water quality monitoring will be conducted to determine the inefficiency. The project is expected to take 2½ years to complete. QAPP development began in January 2003 (Peirce 2003).

Based on the high fecal coliform bacteria counts, the *Primary* and *Secondary Contact Recreational Uses* are assessed as impaired for the upper 2.43 square miles. The lower 0.22 square miles are assessed as support based on the DMF shellfish classification (approved).

East Branch Westport River (MA95-41) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|---|---|----------------|--|---|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (decline of eelgrass bed habitat) | Total nitrogen | Animal feeding operation, municipal separate storm sewer systems | On-site septic systems, Changes in tidal circulation/flushing |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 2.01 mi ² SUPPORT 0.64mi ² IMPAIRED | Fecal coliform bacteria | | Animal feeding operation, dairy outside milk parlor area, grazing in riparian zone, municipal separate storm sewer systems | On-site septic systems, highway/road runoff |
| Primary Contact |  | 2.43 mi ² IMPAIRED 0.22 mi ² SUPPORT | Fecal coliform bacteria | | Animal feeding operation, dairy outside milk parlor area, grazing in riparian zone, municipal separate storm sewer systems | On-site septic systems, highway/road runoff |
| Secondary Contact |  | 2.43 mi ² IMPAIRED 0.22 mi ² SUPPORT | Fecal coliform bacteria | | Animal feeding operation, dairy outside milk parlor area, grazing in riparian zone, municipal separate storm sewer systems | On-site septic systems, highway/road runoff |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS EAST BRANCH WESTPORT RIVER (MA95-41)

- Review the results of the ACOE flushing study and implement recommendations as appropriate. Data from the report could be used to assess the *Aquatic Life Use*.
- Review the sediment chemistry and biomonitoring results of the CZM Coastal 2000 Project to assess the status of the *Aquatic Life Use* and investigate the potential source of sediment toxicity at Station 35A near Little Ram Island.
- Continue to support the implementation of best management practices (BMPs) at dairy farms within the region to reduce bacteria/nutrient inputs to the subwatershed.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, to improve water quality and spawning habitat. If applicable, review for data to assess the *Aquatic Life Use*.
- Develop a monitoring program for bacteria to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, compliance with CAFO permit, and the Phase II community storm water management programs and to continue to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports (sanitary surveys and triennial reports) to reduce bacteria and remediate sources causing the closure of the shellfish beds. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and recreational uses.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to continue to assess the *Aquatic Life Use*.
- Implement those 11 salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WP04 through WP14. Site WP06 is at the Hix Bridge where the Massachusetts Highway Department has a reconstruction project scheduled for 2003. Develop a monitoring plan to assess the effectiveness of the projects and to assess the *Aquatic Life Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Review data to assess the *Aquatic Life Use*.

WEST BRANCH WESTPORT RIVER (SEGMENT MA95-37)

Location: Outlet Grays Mill Pond, Adamsville, Rhode Island to mouth at Westport Harbor, Westport

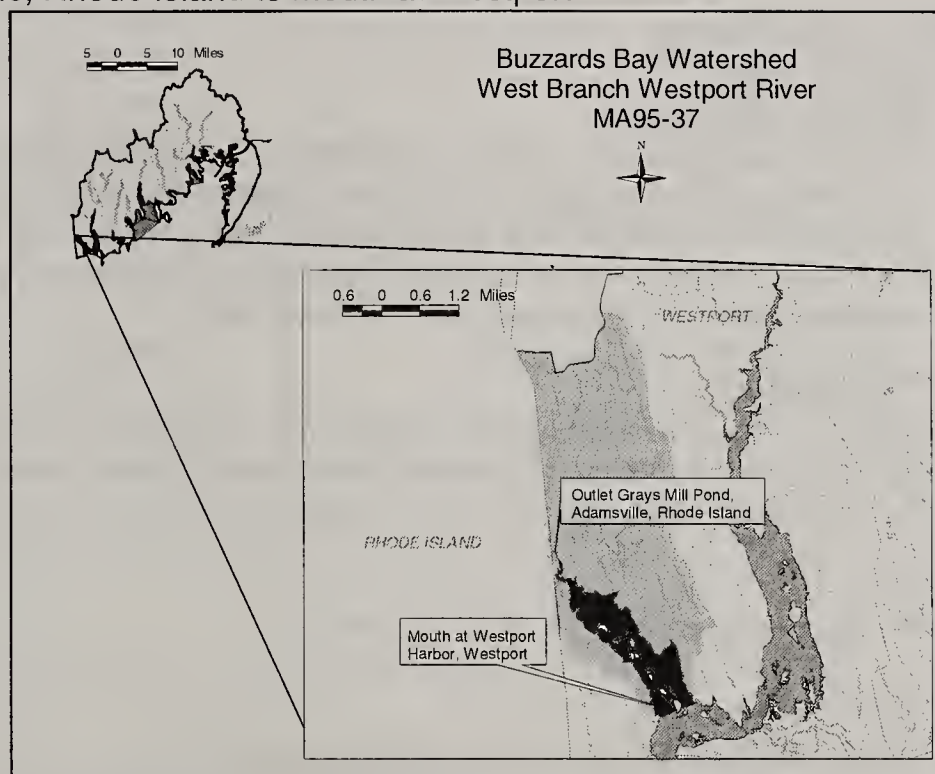
Segment Area: 1.28 square miles

Classification: Class SA, Shellfishing (Open)

The Massachusetts portion of the drainage area for this segment is approximately 9.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 67 % |
| Agriculture | 19 % |
| Residential | 10 % |

This segment is on the Massachusetts 1998 303(d) List of Waters as not meeting water quality standards for pathogens (MA DEP 1999).



MassWildlife has proposed that Dughams and Angeline brooks, tributaries to this segment be reclassified in the SWQS as a cold water fishery (MassWildlife 2001).

The headwaters of the West Branch Westport River form an impoundment at Adamsville Pond, which is also known as Greys Mill Pond. Since 1675 the pond has been utilized to operate Grey's Grist Mill and has historically been the spawning grounds for river herring, primarily alewives. However, the dam at the outlet precludes herring from reaching the pond. The owners of the mill have been actively involved in maintaining fish passage to the pond. In 1995, the Town of Westport, assisted by DMF, installed a wooden fish ladder along the south side of the dam and brook. On March 31, 2001, seven inches of rain resulted in flooding and destruction of the fish ladder. The Town, in consultation with DMF and the United States Department of Agriculture Natural Resources Conservation Service, replaced the ladder in the winter of 2002. The aluminum steep pass ladder utilizes a complex baffling system that allows the herring to pass into the spawning area quickly and with less effort. During the spring of 2002, volunteer fish counts were conducted to determine the effectiveness of the ladder (BBP 2002a).

The Coalition for Buzzards Bay has conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations on this segment of the West Branch Westport River between May and September from 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Coalition states that the system is currently experiencing "nutrient related habitat decline" as supported by the disappearance of eelgrass beds in the upper estuary, elevated total nitrogen and chlorophyll *a* concentrations, low Secchi depths, and periodic oxygen depletions (defined by CBB as <60% saturation). Eelgrass beds are present in the lower third to half of the region. Sources of nitrogen loading identified by the Coalition include crop and animal agriculture and residential and commercial development (Howes *et al.* 1999). The Coalition's 1997-2001 Average Health Index Score for this segment is 56.1 (fair) (CBB undated b).

WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are no regulated water withdrawals from this subwatershed.

NPDES SURFACE DISCHARGE SUMMARY

Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and

enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the West Branch Westport River from historic 1951 black and white aerial photography. Eelgrass beds in the West Branch Westport River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Loss of eelgrass beds occurred along the western shore between Sanford Flat and Canoe Rock. Decline of the beds along the eastern shore occurred between Judy Island and Sanford Flat.

Chemistry-water

WRWA conducted temperature, salinity, pH, and turbidity monitoring at one station in the river off of 448 River Road (station 6) between March and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002 and WRWA 2001).

pH

pH ranged from 7.75 to 8.16 SU (n=18).

Temperature

Temperature ranged from 2.22 to 24.44 °C (n=18).

Turbidity

Turbidity ranged from 0.69 to 3.06 NTU (n=18).

Salinity

Salinity ranged from 19.4 to 32.3 ppt (n=18).

Due to the loss of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for the West Branch Westport River. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include animal feeding operations, storm drains, and septic systems.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB3.0 is approved, BB3.11 and BB3.12 are conditionally approved, and BB3.3 and BB3.6 are prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for 0.50 mi² and impaired for 0.78 mi².





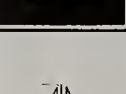

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococcus bacteria* samples at one station in the river near 448 River Road (station 6), between March and October 2001 (Carvalho-Souza 2002). Fecal coliform bacteria counts from this location ranged from 0 to 2,500 cfu/100mL (n=19). Of the 17 samples collected during the primary contact recreational season the geometric mean was 8.6 (excluding zero values) and only one count (6%) was greater than 400 cfu/100mL. Samples were collected during both wet and dry weather and the two highest counts were recorded during wet weather conditions.

Enterococci counts ranged from 0 to 3,200 cfu/100mL.

Based on the low fecal coliform bacteria counts in the river near 448 River Road and the stricter shellfish guidelines, the *Primary* and *Secondary Contact Recreational uses* are assessed as support for lower 0.5 mi² but are not assessed for the upper 0.78 mi².

West Branch Westport River (MA95-37) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|--|--|----------------|---------|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (loss/decline of eelgrass bed habitat) | Total nitrogen | | Animal feeding operation, municipal separate storm sewer systems, on-site septic systems |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 0.5 mi ² SUPPORT 0.78 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | SUPPORT lower 0.5 mi ² NOT ASSESSED 0.78 mi ² | | | | |
| Secondary Contact |  | SUPPORT lower 0.5 mi ² NOT ASSESSED 0.78 mi ² | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS WEST BRANCH WESTPORT RIVER (MA95-37)

- Continue to support the implementation of best management practices (BMPs) at farms within the region to reduce bacteria and nutrient inputs to the West Branch Westport River.
- Review and implement recommendations in the DMF anadromous fish assessment report (when available) to improve water quality and increase habitat. If applicable review data to assess the *Aquatic Life Use*.
- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and on-site septic system improvements and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports (sanitary surveys and triennial reports) to reduce bacteria and remediate sources causing the closure of the shellfish beds. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Work with the Coalition for Buzzards Bay to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to continue to evaluate the status of the *Aquatic Life Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Review data to assess the *Aquatic Life Use*.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.
- Implement the four salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WP01, WP02, WP 15 and WP16. Develop a monitoring plan to determine the effectiveness of the restorations and to assess their impacts on the *Aquatic Life Use*.

WESTPORT RIVER (SEGMENT MA95-54)

Location: From the confluences of the East and West Branches of the Westport River to Rhode Island Sound at a line drawn from the southwestern point of Horseneck Point to the easternmost point near Westport Light, Westport (consistent with DMF DSGA BB3.0)

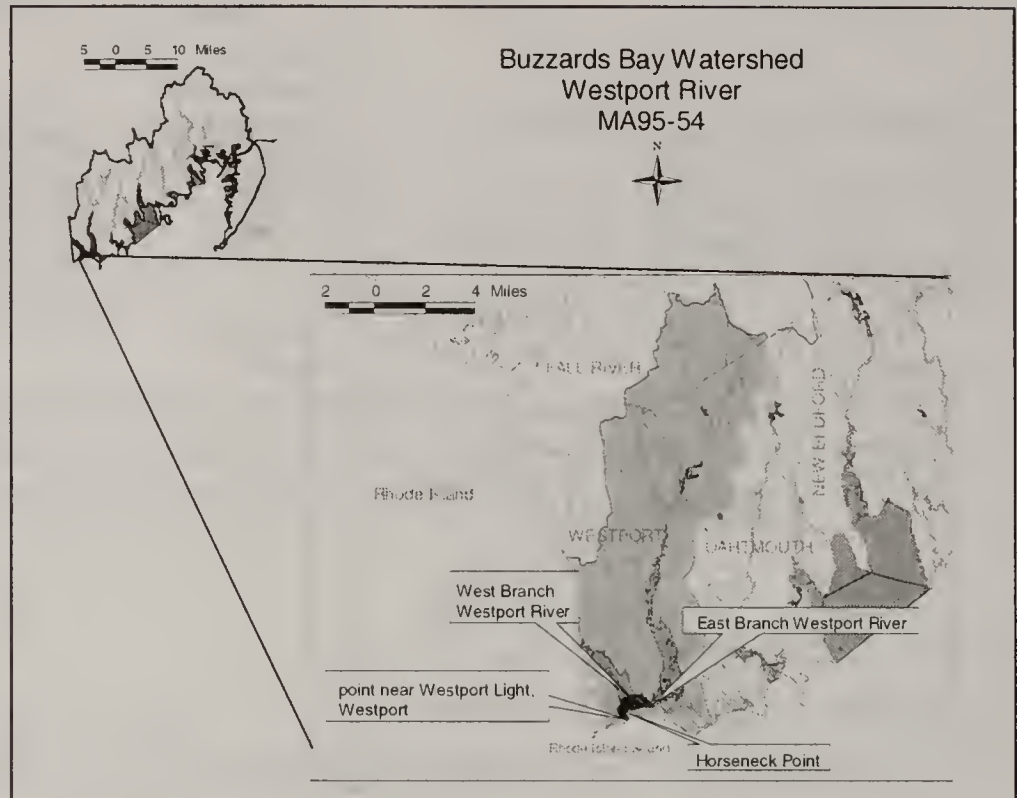
Segment Area: 0.74 square miles

Classification: Class SA

The drainage area of this segment is approximately 71.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 65% |
| Residential | 14% |
| Agriculture | 10% |

ACOE is evaluating a project to dredge the entrance channel to the Westport River from Buzzards Bay at the request of the Town of Westport (ACOE 31 January 2002).



The Coalition for Buzzards Bay has conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in the Westport River between May and September 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Coalition states that the system is currently experiencing “nutrient related habitat decline” as supported by the disappearance of eelgrass beds in the upper estuary, elevated total nitrogen and chlorophyll *a* concentrations, low Secchi depths, and periodic oxygen depletions (defined by CBB as <60% saturation). Eelgrass beds are present in the lower third to half of the region. Sources of nitrogen loading identified by the Coalition include crop and animal agriculture and residential and commercial development (Howes *et al* 1999). The Coalition’s 1997-2001 Average Health Index Score for the Westport River inlet is 80.4 (good/excellent) (CBB undated b).

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no known regulated WMA water withdrawals or NPDES discharges in this segment. It should be noted, however, that Westport is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the Westport River from historic 1951 black and white aerial photography. Eelgrass beds in the Westport River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Decline of the beds occurred in the vicinity of Whites Flat, the Westport Yacht Club, Hudson Cove, Canoe Rock, and Baileys Flats and Cory’s Island.

Chemistry-water

WRWA conducted temperature, salinity, pH, and turbidity monitoring at two stations: off of Westport Point Town Wharf (station 11A) and the Harbor entrance at Charlton Wharf (station 7) between March

and October 2001. Samples were collected during ebb or flood tide between 0600 and 1300 (Carvalho-Souza 2002).

pH

pH ranged from 7.68 to 8.18SU (n=36).

Temperature

Temperature ranged from 2.2 to 23.6°C (n=36).

Turbidity

Turbidity ranged from 0.29 to 1.90 NTU (n=36).

Salinity

Salinity ranged from 22.4 to 32.4 ppt (n=36).

Due to the decline of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for this segment of the Westport River. This loss may be attributed to nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources and recreational uses or other anthropogenic activities that result in reduced water clarity Suspected sources of nutrient enrichment include animal feeding operations, storm drains, recreational activities (boating) and septic systems.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB3.0 is approved, BB3.5 is conditionally approved, and BB3.7 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 0.7 mi² and impaired for 0.04 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

WRWA collected fecal coliform and *Enterococcus* bacteria samples at two stations: off of Westport Point Town Wharf (station 11A) and the Harbor entrance at Charlton Wharf (station 7) between March and October 2001(Carvalho-Souza 2002). Their data are summarized below:







| Station | Fecal Coliform Bacteria Range (cfu/100mL) | Geometric Mean (cfu/100mL) |
|--|--|-------------------------------|
| 11A (n=19, 17 samples collected during the primary contact season) | <1 - 1040 | 5.02 1 sample > 400 (6%) |
| 7 (n= 9*; all samples collected during primary contact season) | 1 -157 | 5.93 |

*Note: samples with values reported as zero were not reported here.

Enterococci counts at station 11A ranged from 0 to 410 cfu/100mL (n=17). The counts at station 7 (n=17) ranged from 0 to 240 cfu/100mL (Carvalho-Souza 2002).

Based on the low fecal coliform bacteria counts and the DMF shellfish classification information, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support.

Westport River (MA95-54) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|---|---|---|---------|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (decline of eelgrass bed habitat) | Total nitrogen, other anthropogenic substrate alterations | | Animal feeding operation, municipal separate storm sewer systems, on-site septic systems |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 0.70 mi ² SUPPORT 0.04 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | SUPPORT | | | | |
| Secondary Contact |  | SUPPORT | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS WESTPORT RIVER (MA95-54)

- Review and implement recommendations in the DMF anadromous fish assessment report (when available) to improve water quality and increase habitat. If applicable, review data to assess the *Aquatic Life Use*.
- Continue to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce pollutants causing the closure of the shellfish beds. Continue to review the DMF Shellfish Status Reports to assess the *Shellfish Harvesting Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.
- Continue to work with the WRWA to promote education and outreach programs to protect surface water resources. Offer technical support and guidance to WRWA to continue/expand their water quality monitoring program. Review final reports to assess the *Aquatic Life Use* and the recreational uses.
- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WP03, WP17 through WP20. Develop a monitoring plan to determine their effectiveness and to assess the improvements to water quality and the aquatic life.

THE SLOCUM/PASKAMANSET RIVER DRAINAGE AREA

The Slocum/Paskamanset River Drainage Area in Dartmouth and New Bedford consists of two segments:

- Paskamanset River (Segment MA95-11)
- Slocums River (Segment MA95-34)

PASKAMANSET RIVER (SEGMENT MA95-11)

Location: Outlet Turner Pond, Dartmouth/New Bedford to confluence with Slocums River, Dartmouth

Segment Length: 10.27 miles

Classification: Class B

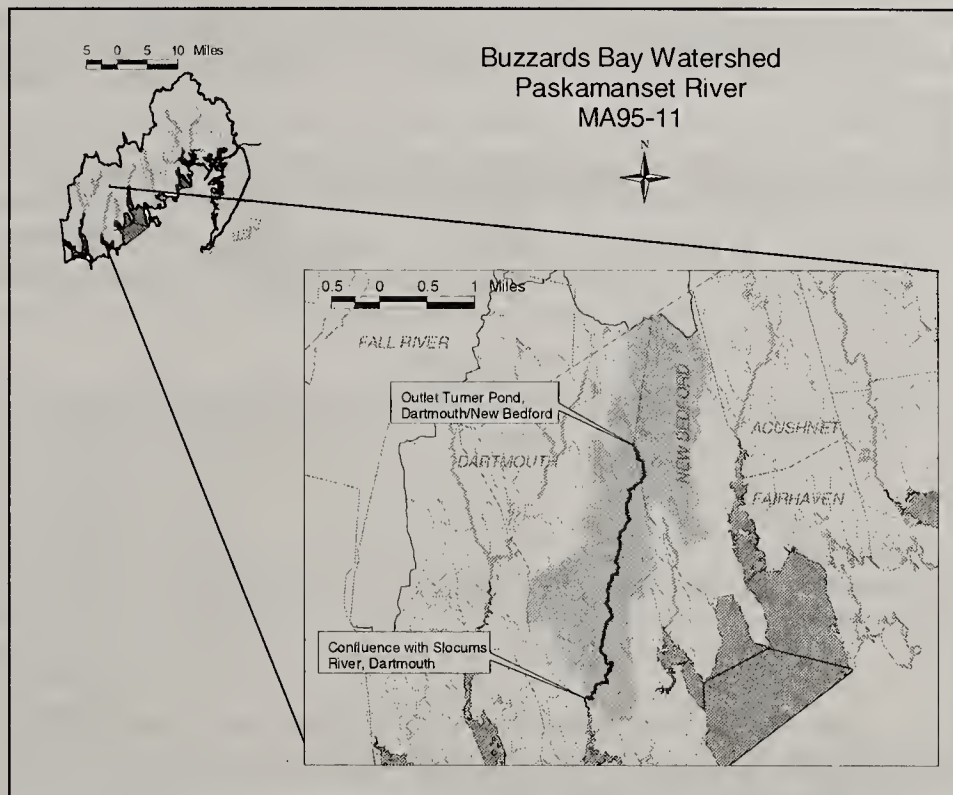
The drainage area of this segment is approximately 28.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 58% |
| Residential | 15% |
| Open Land | 11% |

This segment is on the Massachusetts 1998 303(d) List of Waters, needing confirmation, as not meeting water quality standards for pathogens (MA DEP 1999).

A quarry was operated at the 12-acre Sullivan's Ledge disposal area, located within the Paskamanset River watershed in the northwestern corner of New Bedford, until about 1932. In 1935 the City of New Bedford acquired the site through tax title foreclosure. Between the 1940s and the 1970s local industries used the quarry pits and adjacent areas for disposal of hazardous material and other wastes including electrical capacitors, fuel oil, volatile liquids, tires, scrap rubber, demolition materials, brush and trees. After a fire at the site in the 1970s, the City backfilled the only existing open pit and covered all exposed refuse. In 1982, electrical capacitors were unearthed when the Massachusetts Department of Public Works drilled test borings as part of a plan to build a commuter parking lot. Concentrations of volatile organic compounds (VOCs) in the groundwater on-site and immediately off-site increased with depth. Inorganic compounds and PCBs were also present in the groundwater. The soil was contaminated with PCBs and polycyclic aromatic hydrocarbons (PAHs) with the highest contaminant concentrations found along the eastern and southern boundaries. Soils eroded from the site and were transported by an unnamed stream. Sediments contaminated with PCBs were found in an unnamed stream, Middle Marsh, four golf course water hazards, and a portion of the Apponagansett Swamp. The quarry area was capped to reduce potential exposure and long term groundwater treatment is in place. Likewise, the unnamed stream, Middle Marsh, and water hazards have been cleaned and the resulting materials buried within the on-site cap (EPA 13 December 2002 c).

From 1997-2001, the Buzzards Bay Project conducted a 319 project to demonstrate proactive land conservation as a viable tool for nitrogen management through the use of conservation restrictions, outright land purchase, and agricultural preservation restrictions. The Smith Mills Property is located at the headwaters of the Paskamanset River and lies within an Aquifer Protection District; park benches and a canoe access site were planned for the property (BBP 1997-2001).



In 2000 the Coalition for Buzzards Bay began water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Sécchi depth) at one station in the Paskamanset River between May and September. Samples have been collected between 6 and 9 am.

Three landfills are located within this subwatershed. The Greater New Bedford Compost Site, a landfill owned by the Greater New Bedford Refuse District, is partially located within this subwatershed on Dartmouth/Freetown town line (MA DEP BWP 2000). The Dartmouth Municipal Landfill is located on Russells Mills Road, Dartmouth, approximately 1000 feet from the Paskamanset River. Between the 1970's and 1994 the landfill received sludge from the Dartmouth WWTP. In 1996 the landfill was capped, and a leachate collection system was installed (Howes *et al* 1999). The third landfill, the New Bedford Municipal Landfill, is located north of Hathaway Road and west of Route 140, approximately one-half mile from the Paskamanset River. It received reject capacitors and other waste products containing PCBs from Aerovox and Cornell Dubilier Electronics, as well as residuals (grit, sludge, ash) from the New Bedford WWTP.

WMA WATER WITHDRAWAL SUMMARY * (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|------------------------------|---------|-------------------|-------------------------|---|---------------------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Country Club of New Bedford | | 9P42407202 | | | 0.19 | 0.07 | 0.01 | 0.09 |
| Dartmouth Water Department** | 4072000 | 9P242407201 | 42407202 | 4072000-01G 4072000-02G 4072000-03G 4072000-05G 4072000-06G 4072000-07G 4072000-08G 4072000-09G 4072000-10G 4072000-11G 4072000-12G | Registered = 1.35 Permitted = 2.11 | 3.07 | 2.97 | 2.83 |

*Excludes any authorized cranberry growers.

**Dartmouth Water Department has twelve withdrawal points in the Buzzards Bay Basin – eleven in Segment 95-11 and one in Segment 95-40. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined.

Dartmouth is required to monitor streamflows in the Paskamanset River at the USGS gage station near Russells Mills. During the summer low flow period between June 1 and September 14, withdrawals from Dartmouth Wells E-1, E-2, F-1 and F-2 shall cease on any day during which streamflow at the stream gauge at Russells Mills Road falls to 5.0 cubic feet per second (cfs) and shall not resume until the date when streamflow increases to reach or exceed 5.0 cfs. The Town has developed a conservation plan to conserve water that includes metering, leak detection and repair, and education users.

There are 28.612 acres of cranberry bog open space in the Paskamanset River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 0.26 MGD.

NPDES SURFACE WASTEWATER DISCHARGE SUMMARY

The following general storm water permits were issued by the EPA in October 2001 and will expire in October 2005:

Titleist and Foot Joy Ball Painting MAR05B930
Dartmouth Hub MAR05B896
Ergste Westig Massachusetts LP MAR05B835
Crapo Hill Landfill MAR05B826
Titleist Pilot Production Proc Dev MAR05B933

Polaroid Corporation MAR05B909
AFC Cable Systems MAR05C228
Depuy A Johnson & Johnson CO MAR05B888
Goyette's Inc. MAR05B913

The Town of Dartmouth (MA0033588) is permitted (16 September 1992) to discharge emergency overflow from lagoons at the Chase Road Well D Water Treatment Plant via outfall 001 to this segment.

Dartmouth and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

There is one active USGS stream gage in the Buzzards Bay Watershed located on the Paskamanset River at the bridge near Russells Mills Road, South Dartmouth. The period of record for this gage (0115933) is October 1995-present. The average discharge for the six years is 53.3 cfs. The maximum discharge occurred on 31 March 2001 (772 cfs) and the minimum discharge occurred on 8 August 1999 (0.38 cfs). The 7Q10 for the Paskamanset River at this gage is 0.7 cfs (USGS October 2002). It should be noted that 1999 was a drought year (USGS 5 June 2001). Mean monthly discharges in cubic feet per second for the months of May, June, July, August, and September are provided in the table below (Socolow *et al* 1998, 1999, 2000, and 2001).

Table 3. Mean monthly discharges for the Paskamanset River at USGS Gage 0115933

| Year | May | June | July | August | September |
|------|------|------|------|--------|-----------|
| 2001 | 44.5 | 102 | 20.7 | 21.2 | 9.58 |
| 2000 | 58.2 | 36.4 | 13.1 | 22.7 | 7.92 |
| 1999 | 28.2 | 5.67 | 1.72 | 2.65 | 9.37 |
| 1998 | 87.9 | 115 | 41.8 | 12.9 | 8.33 |
| 1997 | 42.3 | 18.6 | 4.27 | 13.2 | 5.87 |

A USGS study published in 1995 entitled *The Streamflow, Ground-Water Recharge and Discharge, and Characteristics of Surficial Deposits in Buzzards Bay Basin, Southeastern Massachusetts* indicated that major ground water withdrawals severely impact streamflows in this river and in the Mattapoissett (Bent 1995).

There is a weir pool and denil fishway located northeast of Rock Dundee Road, at the Russells Mill Dam in the Russells Mills Village, Dartmouth, that allows passage of some fish species to the freshwater portion of the Paskamanset River (DFWELE 1997). In 2000, DMF and Dartmouth began repairing this ladder. DMF plans to continue work on the ladder (Brady 2003). It should be noted that there is an eleven-foot cascade at the confluence of Destruction Brook and the Paskamanset River that impedes fish passage. The Dartmouth Natural Resources Trust is conducting an assessment to determine possibilities for improved fish passage to Destruction Brook (DNRT 2003).

"An Assessment of the Fish Assemblage and Habitat Quality of the Paskamanset River Near the Town of Dartmouth, Massachusetts" was prepared for Woodard & Curran and the Town of Dartmouth by New England Environmental, Inc. of Amherst, MA and Ichthyological Associates, Inc. of Lansing, NY in January 1995.






Too limited instream physicochemical/biological data are available and, therefore, the *Aquatic Life Use* is currently not assessed for the Paskamanset River. While minimum streamflow thresholds have been developed for WMA permittees in this subwatershed, potential effects of water withdrawals have not recently been evaluated and, therefore, are still of concern. Consequently, the *Aquatic Life Use* is identified with an Alert Status.

FISH CONSUMPTION

It should be noted that fish toxics monitoring was conducted at three stations in the Paskamanset River subwatershed by DWM in 1988; Turner Pond, New Bedford/Dartmouth, unnamed tributary along New Bedford Municipal Airport southwest runway, New Bedford and Smith Mills Pond, Dartmouth. PCB concentrations did not exceed the MDPH action level of 1.0 mg/Kg in any of the samples analyzed

(Maietta 1989b). Mercury concentrations were above the MDPH action level of 0.5 mg/Kg in fish tissue from Turner Pond resulting in MDPH issuing an advisory (see lakes assessment section). In addition, slightly elevated mercury concentrations (2 samples) were found in fish from Smith Mills Pond, however, due to the fact that one sample was an individual fish and the other was incorrectly identified as an individual fish (was actually composite) no advisory was issued. Since no site-specific fish consumption advisory was issued for the river, the *Fish Consumption Use* is not assessed.

Paskamanset River (MA95-11) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|--|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified-- see details in the use assessment section

RECOMMENDATIONS PASKAMANSET RIVER (MA95-11)

- Develop a monitoring plan to evaluate the impacts of water withdrawals on streamflow/habitat in this segment/subwatershed to assess the *Aquatic Life Use*.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment. If applicable, review data to assess the *Aquatic Life Use*.
- MPDH is currently reevaluating their Fish Consumption Advisory for Smith Mills Pond and the Paskamanset River between Turners Pond and this location. Additional fish toxics monitoring should be considered for this segment if deemed necessary to refine the extent of the advisory.
- Investigate and abate potential sources of contamination including storm water discharges and landfills that may contribute to degraded water quality in this segment and downstream in the Slocums River.
- The *Turn the Tide* initiative “will create a restoration plan for the Slocums/Little River Estuary and Apponagansett Bay”. Partners in the Turn the Tide initiative should consider developing a similar program in the Paskamanset River to identify potential sources of pollution and remediate known sources that may be contributing to degraded water quality in the Slocums River.

SLOCUMS RIVER (SEGMENT MA95-34)

Location: Rock O'Dundee Road (confluence with Paskamanset River), Dartmouth, to mouth at Buzzards Bay, Dartmouth

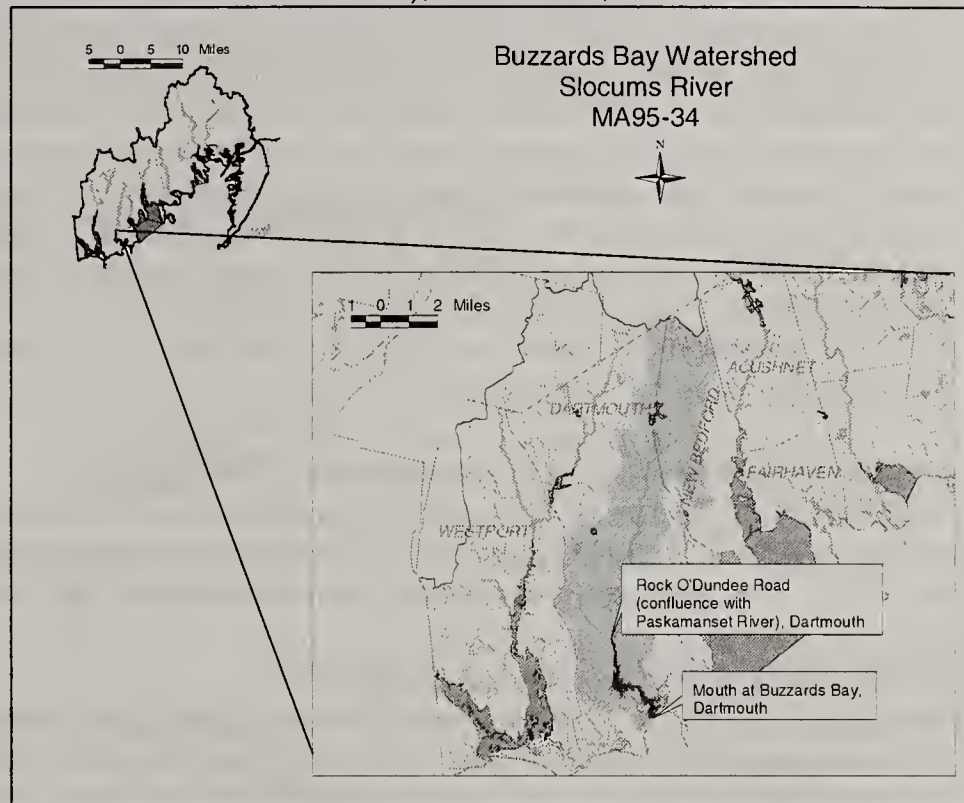
Segment Area: 0.67 square miles

Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 37.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 60% |
| Residential | 14% |
| Open Land | 9% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



From 1997-2001 the Buzzards Bay Project conducted a 319 project to demonstrate proactive land conservation as a viable tool for nitrogen management through the use of conservation restrictions, outright land purchase, and agricultural preservation restrictions. In the Slocums River Subwatershed, the Dartmouth Natural Resources Trust, The Trustees of Reservations, and the Town of Dartmouth purchased the 16-acre Island View Farm, the 614-acre Dartmoor Farm, the 303-acre Destruction Brook Woods, and the 0.72 acre Smith Mills Property. 506 acres of Dartmoor Farm were sold to DFWELE and made into the Dartmoor Wildlife Management Area (BBP 1997-2001).

The *Turn the Tide* initiative “will create a restoration plan for the Slocums/Little River Estuary and Apponagansett Bay. The project will assess non-point source pollution loads in these waterways, educate the community about the dangers of ignoring this water quality issue and ultimately create a restoration strategy to be implemented by citizen action.” More details about Turn the Tide can be found on-line at <http://www.savebuzzardsbay.org/www/advocacy/turn-the-tide.htm>

Demarest Lloyd State Park is one of the “best kept secrets in the Massachusetts forest and park system”. An 1800-foot saltwater beach is backed by rambling hills of beach grass and shaded, grassy picnic sites. A broad, scenic marsh lines the Slocum River on the park's eastern edge. The Buzzards Bay surf is calm and shallow, giving rise to warm water temperatures through most of the summer. It is also a great spot to see egrets, herons, ospreys, terns and hawks (MA DEM Undated e). Public access to the eastern side of the Slocums' shores is provided at the 55-acre Katharine Nordell Lloyd Center for Environmental Studies, Inc. The Lloyd Center (<http://www.thelloydcenter.org>) is a not-for-profit education and research organization whose mission is to help create the next generation of environmental stewards - through education and research (Lloyd Center 2001).

Applied Coastal Research and Engineering, Inc. was awarded a Massachusetts Watershe Initiative grant in FY 2002 to conduct flushing studies for the Slocums and Little River in Dartmouth in concert with the Massachusetts Estuaries Project. This involved collecting quality-assured field data (such as tidal cycle, bathymetry and streamflow) and developing hydrodynamic models for each embayment as well as the potential movement of water between the two rivers. Using data collected between April and May 2002, the estimated flushing rate in the Slocums River was 0.55 days. The particle tracking model indicated that nutrients in the water from the upper Slocums River is recycled for a number of tidal cycles and “will likely have a significant impact on the overall estuarine health” (Ruthven *et al.* 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in the Slocums River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Slocums River is a "classic drowned estuary, formed by the flooding of an eroded river valley by rising relative sea level" and supports significant saltmarsh habitat. Eelgrass beds are sparse to absent and sediments are soft and organic-rich with a "mayonnaise consistency", which is common in eutrophic coastal waters. Shellfish abundance is sparse, with most found in localized areas near the banks (Howes *et al.* 1999). High nitrogen and chlorophyll *a* concentrations, poor water transparency and frequent oxygen depletion resulted in poor Health Index Scores for the Inner Slocums (the average 1997-2001 score was 29.3). The Outer Slocums River received an average score of 53.6 (fair) (CBB undated b and Howes *et al.* 1999).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 74.617 acres of cranberry bog open space in the Slocums River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.41 MGD. This estimate includes the estimate of water use for the upstream segment MA95-11.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated wastewater discharges to this subwatershed, however, Dartmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003). It should be noted that upstream of this segment in the Paskamansett River, there are numerous general permittees that ultimately discharge to this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in the Slocums River from historic 1951 black and white aerial photography. A field survey performed by MA DEP in 1998 revealed no eelgrass in the entire river (Costello 2003).

Because of the loss of eelgrass bed habitat, the *Aquatic Life Use* is assessed as impaired for this segment. This loss has been attributed to nutrient enrichment (i.e., elevated nitrogen loadings) or other anthropogenic activities that result in reduced water clarity. Potential sources of nutrient enrichment include septic systems, golf courses, landfills, and high density urban development upstream of this segment in the Paskamansett River subwatershed.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB7.0 is approved and BB8.0 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for 0.01 mi² and impaired for 0.66 mi².

PRIMARY AND SECONDARY CONTACT RECREATION







MA DEM (2002) collected *Enterococci* bacteria samples from their salt water beach in Demarest Lloyd State Park between May and August 2002. The beach was not officially closed or posted according to the MDPH database. This beach is located on Buzzards Bay at the mouth of the Slocums River.

The *Primary and Secondary Contact Recreational Uses* are assessed as support for 0.01 mi² based on the more stringent guidelines for shellfish harvesting. The remaining 0.66 mi² are not assessed.

AESTHETICS

Noxious “soft, goopy, green” algal blooms have been reported in the Slocums River in the vicinity of the Lloyd Center for Environmental Studies (Cohen 2003). Due to the lack of additional information (i.e., duration of bloom {days, months}, species, extent of area affected) the *Aesthetics Use* is currently not assessed for the Slocums River. This use is, however, identified with an Alert Status due to the potential for aesthetic quality degradation.

Slocums River (MA95-34) Use Summary Table

| Designated Uses | | Status | Causes | | Sources |
|-----------------------|---|---|--|----------------|--|
| | | | Known | Suspected | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (loss of eelgrass bed habitat) | Total nitrogen | On-site treatment systems (septic systems), urbanized high density area, municipal separate storm sewer systems, landfills |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | 0.01 mi ² SUPPORT 0.66 mi ² IMPAIRED | Fecal coliform bacteria | | On-site treatment systems (septic systems), urbanized high density area, municipal separate storm sewer systems |
| Primary Contact |  | 0.01 mi ² SUPPORT 0.66 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 0.01 mi ² SUPPORT 0.66 mi ² NOT ASSESSED | | | |
| Aesthetics** |  | NOT ASSESSED | | | |

* For watershed-wide shellfish growing area data see Appendix E.

** Alert Status Issues identified—see details in use assessment section

RECOMMENDATIONS SLOCUMS RIVER (MA95-34)

- DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juveniles. DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of the aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders, thereby increasing habitat, in this segment. If applicable review data to assess the *Aquatic Life Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to continue to assess the *Aquatic Life Use*.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports. Identify sources of bacteriological contamination and abate causes of the shellfish bed closures. Continue to review the DMF Shellfish Status Report to assess the *Shellfish Harvesting Use*.
- Design and conduct a bacteria survey to assess the recreational uses for this segment and to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage/septic system upgrades, and the Phase II community storm water management

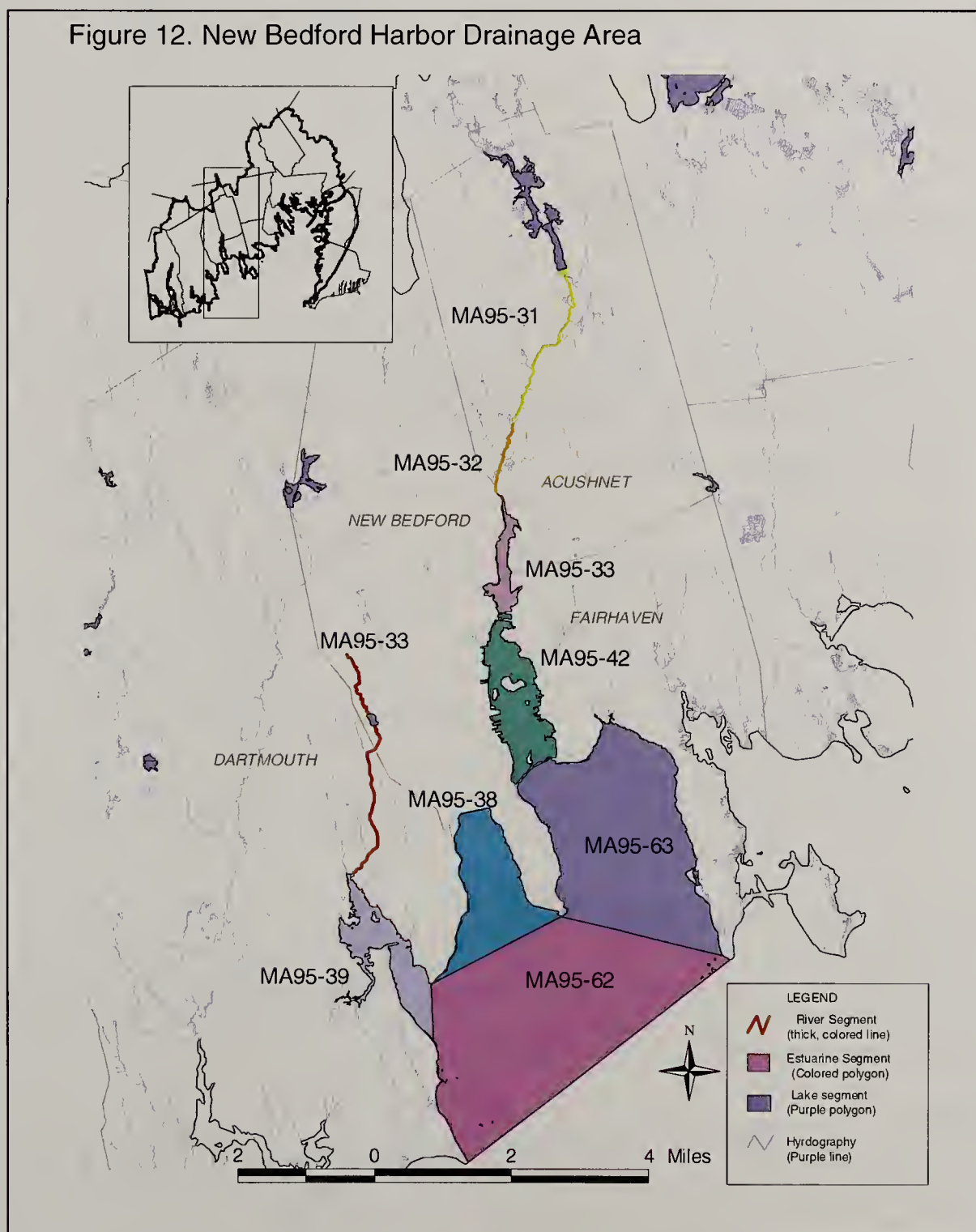
- programs as much of this subwatershed. Under the Beach Bill, Demarest Lloyd State Park is required to conduct bacteria monitoring at the public beach. Continue to review closure information/ bacteria data to assess the recreational uses. An increasing number of recreational paddlers use the Slocums (there is a paddler access point at Russell's Mills at the upstream end of this segment).
- Design and conduct a survey to identify and determine the extent of noxious algal blooms and macroalgae distribution near the Lloyd Center for Environmental Studies. Additional monitoring could be conducted to determine chlorophyll *a* and nitrogen concentrations in the water column. Data from this survey could be used to assess the *Aquatic Life Use*, the recreational uses, and the *Aesthetics Use*.
- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the town. Sites in this subwatershed are DA13, DA23, DA24, DA25, and DA26. Develop a monitoring plan to determine the effectiveness of the restoration projects and to document improvements to water quality and the aquatic life.
- Work with the partners of *Turn the Tide* to implement the recommendations from the project and restore the Slocums River including:
 - identifying sources of pollution in the Slocums/Little Rivers and Apponagansett Bay,
 - developing an Estuary Restoration Strategy for the Slocums/Little Rivers and Apponagansett Bay,
 - educating citizens about the value of these areas to Dartmouth's quality of life and the role we all must play in maintaining them,
 - remediating known sources of pollution on the Paskamansett River and Buttonwood Brook, and
 - creating a model for public and private, community-based restoration that can be used in other areas along Buzzards Bay and throughout New England.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.

THE NEW BEDFORD HARBOR DRAINAGE AREA

The New Bedford Harbor Drainage Area is located in New Bedford, Acushnet, and Dartmouth. In addition to the Harbor the drainage area includes its main tributary (the Acushnet River), two coves (Clark Cove and Apponagansett Bay), and open coastal water outside the three estuaries. The drainage area consists specifically of the following nine segments:

- Acushnet River (Segment MA95-31)
- Acushnet River (Segment MA95-32)
- Acushnet River (Segment MA95-33)
- New Bedford Inner Harbor (Segment MA95-42)
- Outer New Bedford Harbor (Segment MA95-63)
- Clarks Cove (Segment MA95-38)
- Buttonwood Brook (Segment MA95-13)
- Apponagansett Bay (Segment MA95-39)
- Open Water Outside New Bedford Harbor (Segment MA95-62)

Figure 12. New Bedford Harbor Drainage Area



ACUSHNET RIVER (SEGMENT MA95-31)

Location: Outlet New Bedford Reservoir to Hamlin Road culvert, Acushnet

Segment Length: 3.00 miles

Classification: Class B, Warm Water Fishery

The drainage area of this segment is approximately 16.3 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

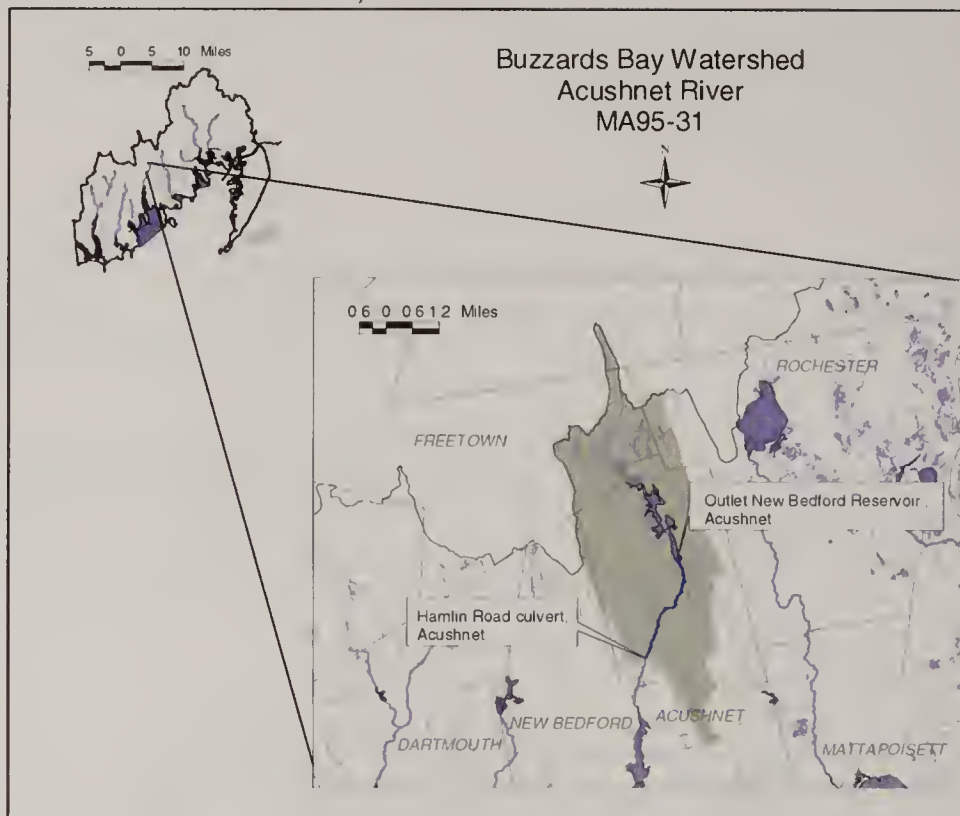
| | |
|-------------|-----|
| Forest | 56% |
| Residential | 18% |
| Open Land | 13% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens, nutrients, organic enrichment/low DO, and siltation (MA DEP 1999).

In 2001 MassWildlife stocked trout in the Acushnet River for recreational fishing (DFWELE 24 September 2002).

Using funds from the New Bedford Harbor Superfund Site remediation, the Division of Marine Fisheries recently completed renovations to the fishway and dam at the outlet of New Bedford Reservoir totaling \$250,000. Two studies are planned to remove the Saw Mill Dam and the dam at Hamlin Street. Environmental Notification Forms were recently completed (Brady 2003).

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed in the next few years for the Acushnet/New Bedford Inner Harbor System, which encompasses this segment.



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|----------------------------|--------|-------------------|-------------------------|---------------------|-----------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Acushnet River Golf Course | | 9P242400301 | | Irrigation Well | 0.1 (permitted) | NA | 0.1 | 0.1 |

* Excludes any authorized cranberry growers NA= Not Applicable

There are 423.711 acres of cranberry bog open space in the Acushnet River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.78 MGD.






NPDES SURFACE DISCHARGE SUMMARY

The Town of Acushnet is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

Due to the lack of current information, the designated uses for this segment are not assessed.

Acushnet River (MA95-31) Use Summary Table

| Aquatic Life | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|---|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

RECOMMENDATIONS ACUSHNET RIVER (MA95-31)

- Develop a bacteria monitoring plan to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the recreational uses.
- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

ACUSHNET RIVER (SEGMENT MA95-32)

Location: Hamlin Road culvert, Acushnet to culvert at Main Street, Acushnet

Segment Length: 1.10 mile

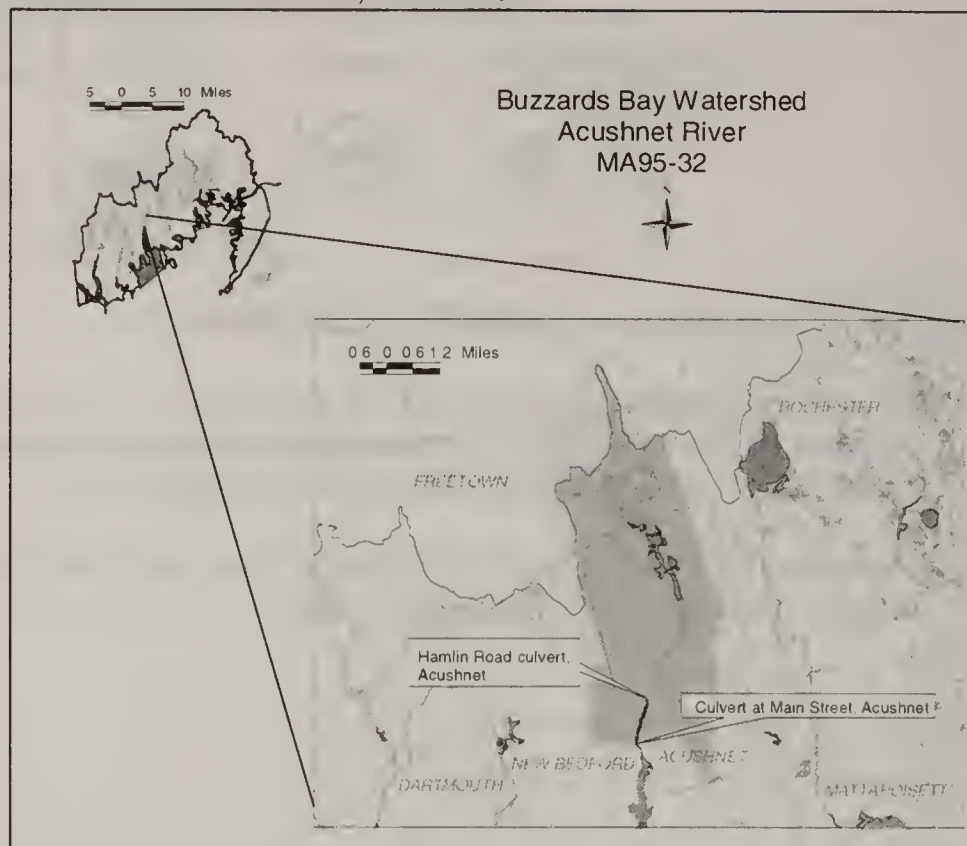
Classification: Class B, Warm Water
Fishery

The drainage area of this segment is approximately 18.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 51% |
| Residential | 22% |
| Open Land | 13% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens, nutrients, and organic enrichment/low DO (MA DEP 1999).

In 2001 MassWildlife stocked trout in the Acushnet River for recreational fishing (DFWELE 24 September 2002).



There is a weir pool that allows fish passage on this section of the Acushnet River (DFWELE 1997). DMF is undertaking a project to remove the two dams on the Acushnet River – the Saw Mill Dam and the dam at Hamlin Street on this segment. Environmental Notification Forms for this \$750,000 project have recently been completed. Funding for these projects is provided in part by the New Bedford Harbor Superfund remediation (Brady 2003).

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Acushnet/New Bedford Inner Harbor System which encompasses this segment.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in this segment of the Acushnet River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). The Acushnet River received an average Health Index Score of 22.7 (poor) due to elevated levels of nitrogen, chlorophyll *a*, and routine oxygen depletion (Howes *et al* and CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY

There are 429.602 acres of cranberry bog open space in the Acushnet River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.84 MGD. This estimate includes the estimate of water use for the upstream segment MA95-31.

NPDES SURFACE DISCHARGE SUMMARY

Acushnet Company- Titleist Golf Division (MA0005428) is permitted (20 November 1986) to discharge treated sanitary waste via outfall 008 and treated process waste, NCCW, and boiler blow-down from outfall 010 to the Acushnet River. The permit includes a 92 °F temperature limit for outfall 010 and secondary limits for BOD= 30 mg/L, TSS = 30 mg/L, oil & grease = 10 mg/L, fecal coliform bacteria = 200/100mL.

The Town of Acushnet is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT






AQUATIC LIFE

Biology

DFWELE Southeast District conducted fish population sampling at two stations (downstream of Hamblin Street and Below Acushnet Saw Mill Dam) on this segment of the Acushnet River on 21 September 2000 using backpack electroshocking gear. Fifty-six American eel (*Anguilla rostrata*), 26 alewife (*Alosa pseudoharengus*), six redbfin pickerel (*Esox americanus americanus*), five pumpkinseed (*Lepomis gibbosus*), five tessellated darters (*Etheostoma olmstedii*), two bluegill (*Lepomis macrochirus*), two yellow perch (*Perca flavescens*), one largemouth bass (*Micropterus salmoides*), and one creek chubsucker (*Erimyzon oblongus*) were collected downstream of Hamblin Street. Below Acushnet Saw Mill Dam 121 mummichogs (*Fundulus heteroclitus*), 56 American eel, 52 alewife, and two fourspined sticklebacks (*Apeltes quadracus*) were collected (Richards 2003).

Due to the limited physico-chemical and biological data for this segment of the Acushnet River, the *Aquatic Life Use* is currently not assessed. However, this use is identified with an Alert Status because of the poor health index rating identified by the Coalition.

Acushnet River (MA95-32) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|---|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified-- see details in use assessment section

RECOMMENDATIONS ACUSHNET RIVER (MA95-32)

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data to assess the *Aquatic Life Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to assess the status of the *Aquatic Life Use*.
- Develop a bacteria monitoring plan to bracket nonpoint source discharges and to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.
- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

ACUSHNET RIVER (SEGMENT MA95-33)

Location: Outlet Main Street culvert, Acushnet to Coggeshall Street bridge, New Bedford/Fairhaven

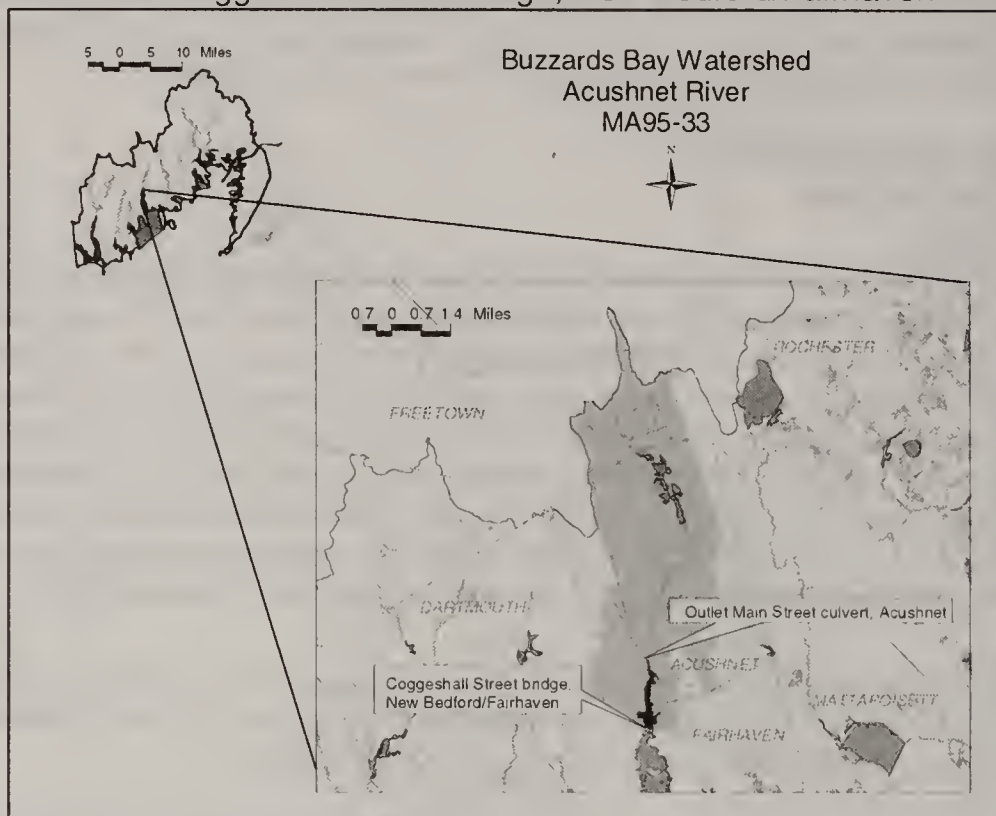
Segment Area: 0.31 square miles

Classification: Class SB,
Shellfishing (Restricted), CSO

The drainage area of this segment is approximately 21.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|------|
| Forest | 45 % |
| Residential | 25 % |
| Open Land | 13% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens, nutrients, organic enrichment/low DO, priority organics and metals (MA DEP 1999).



In 2001 MassWildlife stocked trout in the Acushnet River for recreational fishing (DFWELE 24 September 2002). DMF (1999) noted that all of the creeks and streams that flowed into the harbor have been routed through culverts.

The *Acushnet River TMDL Surface Water Flow and Nitrogen Load: Nitrogen Loading to New Bedford Inner Harbor* project commenced during the winter of 2002. The purpose of this study is:

"to quantify Acushnet River discharge and nitrogen loading from the upper watershed region to New Bedford Inner Harbor and to support the development of water quality models and nitrogen loading thresholds for this system. In addition, analysis will be made to determine the potential for the river to be a source of bacterial (fecal coliform, *E. coli*, *Enterococci*) contamination to the estuary. A stream gauge will be maintained and nitrogen and bacterial samples {will be} collected weekly for 12 months, with additional samples associated with rain events. The goal of the project is to help acquire sufficient data that can later be used by DEP and EPA in the development of appropriate TMDL and management approaches for the restoration of water quality in the Acushnet River Estuary system. Also, the data collected are directly applicable to on-going nitrogen issues relating to management and permitting of NPDES discharges within this system. The project will leverage other proposed and on-going efforts for this system (EMPACT, CZM, EPA) and is an important component for application of the Massachusetts Estuaries Project approach to the Acushnet River Estuary" (Howes and Samimy undated).

The 18,000-acre New Bedford site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs in the production of electric devices from 1940 to the late 1970s, when the EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result the harbor is contaminated, in varying degrees, for at least six miles from the upper Acushnet River into Buzzards Bay. Two major cleanup projects are underway. The first project is a 4.5-acre sediment dewatering and transfer facility. By May 2003 the \$10 million bulkhead for the facility is scheduled to be completed; after which the 50,000 square foot facility can be constructed. Full scale dredging is anticipated to begin in spring 2004. The second project is the cleanup of the Acushnet River area north of Wood Street. Because this area had PCB concentrations up to 46,000 ppm, EPA prioritized this effort. Two temporary dams were built to dewater the sediments. By March 2003 approximately 7 acres of contaminated sediments should be removed. The dams will be removed following sediment remediation and beginning in late spring 2003 an extensive wetland restoration and shoreline planting program is scheduled to begin. Other activities that have been

completed as part of the remediation include the excavation and restoration of the "Early Action" shoreline areas in Acushnet in May 2001. Additionally, to allow for future remedial dredging submerged power cables have been relocated into a utility corridor, 13 abandoned fishing vessels have been removed, and a CSO that discharged to the dewatering area has been relocated (EPA 13 February 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in this segment of the Acushnet River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). The Acushnet River received an average Health Index Score of 22.7 (poor) due to elevated levels of nitrogen, chlorophyll *a*, and routine oxygen depletions (Howes *et al* and CBB Undated b).

WMA WATER WITHDRAWAL

There are 429.602 acres of cranberry bog open space in the Acushnet River subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.84 MGD. This estimate includes the estimate of water use for the upstream segment MA95-32.

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0100781) discharges via ten CSOs to this segment of the Acushnet River. The permit will expire 2 January 2004. Additionally, there are nine storm drain discharges to this segment.

Aerovox Inc. (MA0003379) is permitted (17 December 2000) to discharge storm water via outfall 003 and 005-007 to the Acushnet River/New Bedford Harbor. The permit includes an oil & grease limit = 15 mg/L. Aerovox operated a capacitor manufacturing operation. From the 1940s-1978, the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was required to monitor storm water discharges at the site due to residual PCB contamination. See Sources of Information for additional information.

The following general storm water permits were issued by the EPA in October 2001 and will expire in October 2005:

Riverside Auto Service MAR05B748
Titleist and Foot Joy Ball Planting MAR05B931, MAR05B929
Acushnet Rubber Company MAR05C166, MAR05C167

Acushnet, Fairhaven, and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full-scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al* 1996).

Applied Science Associates, Inc (ASA) was contracted by New England Interstate Water Pollution Control Commission and EPA to perform a flushing study of the Acushnet River estuary (New Bedford Inner Harbor) for use in developing the nitrogen TMDL. As part of the project a dye study was undertaken in October 2001 to estimate residence time of wastewater discharged from the Fairhaven WWTP. Salinity data were collected from 13 stations during high and low tidal conditions each day from 30 October to 2 November 2001 (ASA 2002b).

AQUATIC LIFE

Biology

As part of the New Bedford Harbor Long Term Monitoring Program (NBH-LTR), EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probabilistic sampling design at 27 hexagonal segments with approximately 30 stations per segment throughout the upper, lower, and outer harbor areas. In 1993, the first baseline sampling period, the upper harbor (this segment) exhibited signs of a stressed ecosystem and degraded benthic community based on "opportunistic qualities of the species, low diversity, and low number of dominant species" (Nelson *et al* 1996). Additionally, bioaccumulation studies of PCBs in tissue using the blue mussel, *Mytilus edulis*, and the mummichog, *Fundulus heteroclitus*, have been conducted as part of the NBH-LTR since 1994. Mummichogs were collected from two stations in the upper harbor. Results from 1994 showed a dramatic decreasing gradient with the highest concentrations of PCBs in the upper harbor. Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Toxicity-Sediment

In 1993, as part of the NBH-LTM program, sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on 27 sediment samples from the upper harbor. Average percent survival from these sites was 55% (Nelson *et al.* 1996).

Chemistry-water

Salinity

Salinity measurements reported by ASA as part of the flushing study for the estuary ranged between 12 and 32 ppt with the lower salinity in the upper estuary. The largest gradient was observed in this segment. Salinity change with depth was very small, but variations existed near the surface (ASA 2002b).

Chemistry-sediment

In 1993, as part of the NBH-LTM Program, numerous sediment samples from the 27 sites were collected by a Young-modified van Veen grab sampler from the top 2 cm of New Bedford upper harbor, composited, and analyzed for 18 PCB congeners, TOC, and acid volatile sulfide, and nine metals (Ni, Pb, Cd, Cu, Zn, Hg, As, Se, Cr). The highest sediment concentrations of PCB were in this segment (high of 431 µg/g). In general, total PCB concentrations decreased along a gradient from the upper to the outer harbor (Nelson *et al.* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be out for review in 2003 (Nelson 2003).

From Nelson *et al.* 1996. Average metal and total PCB concentrations (in µg/g dry wt) in the upper harbor sediment from 1993. N (the number of stations in the segment) = 27. S-EL (severe effect level) and L-EL (low effect level) from Persuad *et al.* 1993 in µg/g dry wt.

| Parameter | Average Concentration | S-EL | L-EL |
|------------|-----------------------|------|------|
| As | 5.2 | 33 | 6 |
| Cd | 67 | 10 | 0.6 |
| Cr | 310 | 110 | 26 |
| Cu | 630 | 110 | 16 |
| Hg | 0.43 | 2 | 0.2 |
| Ni | 34 | 75 | 16 |
| Pb | 270 | 250 | 31 |
| Se | 0.32 | NA | NA |
| Zn | 630 | 820 | 120 |
| Total PCBs | 44 | 530 | 0.07 |

The *Aquatic Life Use* is assessed as impaired because of PCB contamination. It should be noted that remediation activities are underway and are being monitored closely by EPA.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB15.1 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

PRIMARY AND SECONDARY CONTACT RECREATION







Because of the active CSO discharges and the poor aesthetic quality (see below) the *Primary* and *Secondary Contact Recreational Uses* are assessed as impaired. It should be noted that the City of New Bedford has eliminated CSOs on the north side of the Coggeshall Street bridge and at Howard Avenue through the redirection of flows and the installation of new sewers (Furtado 2003).

AESTHETICS

Massachusetts Community Water Watch (MCWW) conducted monthly shoreline surveys at four stations on this segment of the Acushnet River: Hamlin Street, Mill Road, Tarklin Hill Road, and Wood Street between October 1999 and April 2000. The Hamlin Street site was the most rural site with stream banks that were well vegetated. Three culverts under the bridge impeded flows and were blocked by wood planks and tree debris. Downstream from the bridge the banks were channelized by a rock retaining wall. Duckweed was noted along with thick epiphytic algae, small patches of oil, and on one occasion a "brownish-orange gooey substance". Stream bank erosion was noted near Hamlin Street, which runs adjacent to the river. Trash was also noted along the roadside. At Mill Street, the riverbanks are vertical cement and rock walls and vegetation is lacking. A CSO was noted to be discharging milky-grayish water with small patches of scum and had a distinct rotten eggs/sewage odor. Trash noted at the CSO included toilet paper, plastic bags, feminine hygiene wrappers and restaurant trash. At Tarklin Hill Road, ten discharge pipes and one CSO pipe were noted. The CSO discharged murky-gray water and a grayish sludge was noted on rocks and the streambed directly below the outfall. Trash and debris at this site consisted of food and beverage containers, toilet paper, motor oil containers, a shopping cart, and metal poles. At the Wood Street site, the streambed was soft, dark mud, and occasionally had an orange tint. There were three pipes discharging raw sewage at least once during the survey. MCWW noted that the pipe directly south of the bridge on the New Bedford side always had a steady flow of sewage and occasionally had an oily scum over the surface. Upstream from the Wood Street bridge, a CSO discharged to a tributary to the Acushnet River. Trash and debris at the Wood Street site was "unsightly" and included Styrofoam cups, large metal car parts, tires, and shopping carts (MCWW 2000).

Based on the abundance of trash and debris, objectionable odors and color, and the CSO discharges this segment of the Acushnet River is assessed as impaired for the *Aesthetics Use*. It should be noted that the City of New Bedford has eliminated CSOs on the north side of the Coggeshall Street bridge and at Howard Avenue through the redirection of flows and the installation of new sewers (Furtado 2003).

Acushnet River (MA95-33) Use Summary Table

| Designated Uses | | Status | Causes | Sources |
|-----------------------|---|--------------|---|---|
| | | | Known | Known |
| Aquatic Life |  | IMPAIRED | PCB | Contaminated sediments, CERCLA NPL (Superfund site) |
| Fish Consumption |  | NOT ASSESSED | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria, PCB | CSO, urbanized high density area, Contaminated sediments, CERCLA NPL (Superfund site) |
| Primary Contact |  | IMPAIRED | Oil & grease, odor, and color, trash and debris | CSO, urbanized high density area |
| Secondary Contact |  | IMPAIRED | Oil & grease, odor, and color, trash and debris | CSO, urbanized high density area |
| Aesthetics |  | IMPAIRED | Oil & grease, odor, and color, trash and debris | CSO, urbanized high density area |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS ACUSHNET RIVER (MA95-33)

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.
- Implement recommendations outlined in the Massachusetts Water Watch Shoreline Survey report to improve the aesthetics of the Acushnet River.
- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, to increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to assess the *Aquatic Life Use*.
- Develop a bacteria monitoring plan to document effectiveness of bacteria source reduction activities including CSO abatement actions (e.g., elimination of cross connections and/or CSO outfalls), treatment of storm water discharges, and the Phase II community storm water management programs and to assess the recreational uses.
- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program and develop a Long-Term CSO Control Plan that will achieve compliance with the water quality standards.
- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.
- Implement the DMF *Sanitary Survey of New Bedford/Fairhaven Inner Harbor (BB: 15.1)* report recommendations (Whittaker 1999) listed below to improve water quality and abate pollutants causing shellfish bed closures. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
 - The City of New Bedford & Town of Fairhaven should establish a pollution abatement plan concentrating on education and regulation directed toward the fishing and recreational fleets.
 - CSO and storm drains that have been compromised by illegal use or structural malfunctions should be addressed immediately.
 - The practice of fish processing houses discarding fish offal and other materials into the harbor should be stopped immediately.
- Implement the two salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are NB02 and NB03. Develop a monitoring plan to document the effectiveness of the restoration and improvements to water quality and the aquatic life.

NEW BEDFORD INNER HARBOR (SEGMENT MA95-42)

Location: Coggeshall Street Bridge to Hurricane Barrier, New Bedford/Fairhaven

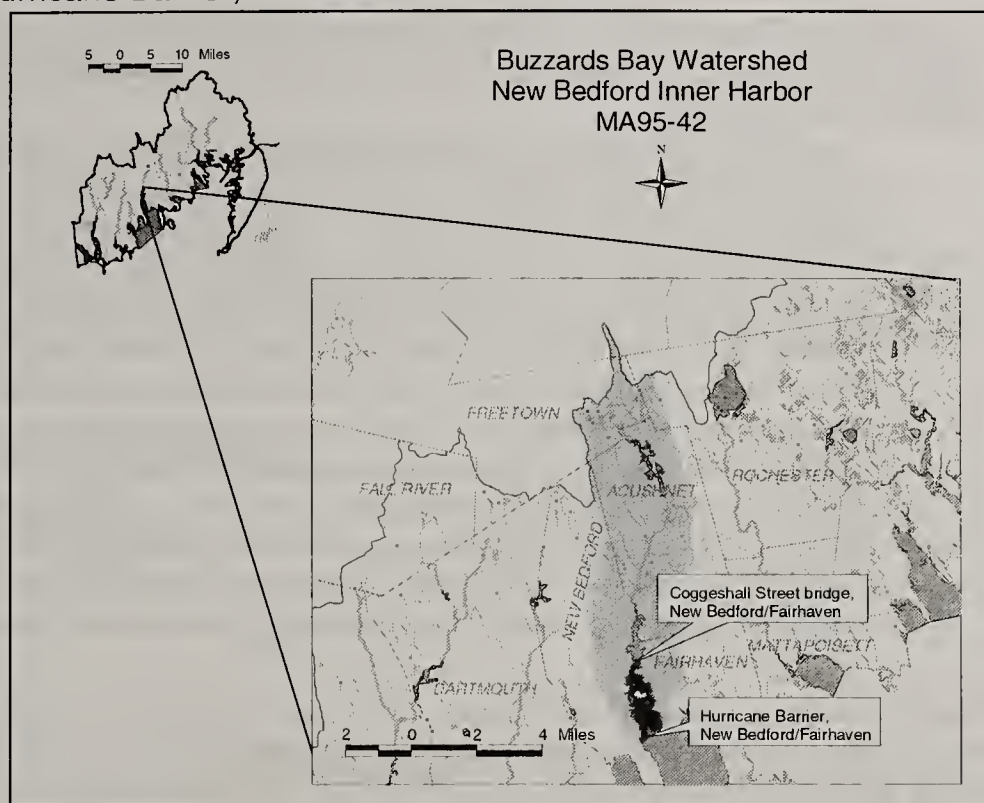
Segment Area: 1.25 square miles

Classification: Class SB, Shellfishing (Restricted), CSO

The drainage area of this segment is approximately 26.5 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 39% |
| Residential | 28% |
| Open Land | 13% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for priority organics, metals, nutrients, organic enrichment/low DO and pathogens (MA DEP 1999).



New Bedford Inner Harbor has a history of water quality problems dating back to colonial times when agriculture adversely impacted the watershed by causing soil erosion and silting of the river. Following the agrarian era, whaling dominated the area during the early 1800s and the associated construction of large wharfs, piers and the Fairhaven bridge increased destruction of salt marshes by restricting tidal flows. Textile manufacturing had the most significant influence on the area by introducing pollutants, especially raw sewage, and occupying the remaining tracts of saltmarsh. The electronics and fishing trades culminate the industrial heritage of the region (DMF 1999). Two major electronics companies manufactured capacitors and utilized as much as 2 million pounds of PCBs per year (Nelson 1996). The effects on the fishing industry have yet to be determined.

The 18,000-acre New Bedford Harbor site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs while producing electric devices from 1940 to the late 1970s, when the EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result, the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay. Two major cleanup projects are underway. A 4.5-acre sediment dewatering facility and transfer facility are planned. Full scale dredging is anticipated to begin in spring 2004. Additionally to allow for future remedial dredging, a corridor for submerged power cables was completed, 13 abandoned fishing vessels were removed, and a CSO that discharged to the dewatering area was relocated (EPA 13 February 2003).

The New Bedford-Fairhaven-Acushnet Hurricane Protection Project, begun in 1962, was completed in 1966 at a cost \$18.6 million. The project is divided into three features: a barrier extending across New Bedford and Fairhaven Harbor with an extension dike on the mainland, Clarks Cove Dike in New Bedford, and Fairhaven Dike. The barrier across the harbor is a 4,500 foot-long earthfill dike with stone slope protection with a maximum elevation of 20 feet (ACOE 1995). Twin sector gates seal the 150 foot-wide navigation channel across New Bedford Harbor in 12 minutes providing tidal flood protection to ~1400 acres and preventing \$17.6 million in damages. In 2000 they were operated nine times (ACOE 31 January 2002). The extension dike begins at the western end of the main dike and extends along Rodney French Boulevard for 4,600 feet. It has a maximum elevation of 22 feet with three circular gated conduits and a street gate on Rodney French Boulevard East. Clarks Cove Dike is a 5,800 feet long earthfill dike with stone slope protection. The dike extends around the north and east sides of the cove. The dike has street gates at Rodney French Boulevard West and Cove Road and a pumping station.

Fairhaven Dike is also an earthfill dike with stone slope protection and a four-foot diameter gated conduit. It begins at the foot of Lawton Street and runs east for about 3,100 feet (ACOE 1995).

The *Acushnet River TMDL Surface Water Flow and Nitrogen Load: Nitrogen Loading to New Bedford Inner Harbor* project commenced during the winter of 2002 as a first phase of the Estuary Project. The purpose of this study is:

“to quantify Acushnet River discharge and nitrogen loading from the upper watershed region to New Bedford Inner Harbor and to support the development of water quality models and nitrogen loading thresholds for this system. In addition, analysis will be made to determine the potential for the river to be a source of bacterial (fecal coliform, *E. coli*, *Enterococci*) contamination to the estuary. A stream gauge will be maintained and nitrogen and bacterial samples {will be} collected weekly for 12 months, with additional samples associated with rain events. The goal of the project is to help acquire sufficient data that can later be used by DEP and EPA in the development of appropriate TMDL and management approaches for the restoration of water quality in the Acushnet River Estuary system. Also, the data collected are directly applicable to on-going nitrogen issues relating to management and permitting of NPDES discharges within this system. The project will leverage other proposed and on-going efforts for this system (EMPACT, CZM, EPA) and is an important component for application of the Massachusetts Estuaries Project approach to the Acushnet River Estuary” (Howes and Samimy undated).

There is public access to the Acushnet River at Pease Park, Fairhaven. The Town of Fairhaven maintains two asphalt boat launches with 30 parking spaces (DFWELE 2002). There is a vessel sewage pump-out facility at Pope’s Island Marina, New Bedford. A pump-out boat is docked at the State Pier for large vessels.

ACOE is assisting CZM in the preparation of a Dredged Material Management Plan for maintenance dredging of the navigation channels in New Bedford and Fairhaven Harbor. The Fairhaven side would require dredging of approximately 70,000 cubic yards of shoal material and the main deep-draft channel has an authorized depth of 30 feet and would require removing 1.3 million cubic yards of material to restore the authorized dimensions. However, navigation traffic projections at this time do not demonstrate a need for dredging those areas. CZM is in the process of developing an Environmental Impact Report that would recommend options for the disposal of dredge materials (ACOE 31 January 2002). ASA used hydrodynamic and pollutant models to simulate circulation, fate and transport of heavy metals, PCBs, and total petroleum hydrocarbons during dredging. Results indicated that an instantaneous release of material would have a greater initial impact on water quality, but concentrations would rapidly decrease with time. A continuous release, however, would result in an increase of pollutant concentrations with time, although none of the contaminant levels would exceed chronic water quality criteria with the exception of copper (ASA 2002a).

Dr. Jefferson Turner, students, and research associates at UMass Dartmouth have conducted 141 monthly cruises of Buzzards Bay between October 1987 and October 1998 to establish temporal and spatial trends of hydrography, water quality, and plankton community structure. Station 8, in the main channel of the inner harbor, was sampled for conductivity, temperature, dissolved oxygen, depth, Secchi disk depth, salinity, nutrients, chlorophyll *a* and phytoplankton. Salinity was “almost uniformly 30 ppt throughout the study at virtually all times”. Salinities were lower at Station 8 immediately after or during heavy rain. Mean surface temperatures at station 8 were below SWQS. The mean Secchi disk depth at station 8 ranged was 2.9 m and ranged from 1 to 5.5 m. DO levels at Station 8 ranged from 2.8 to 14.1 mg/L with a mean of 9.1 mg/L. Chlorophyll *a* concentrations at station 8 ranged between 0.92 µg/L and 64.66 µg/L with a mean of 12.84 µg/L. Ammonium concentrations ranged between 0.00 µM and 19.72µM and averaged 4.09µM. Phosphate ranged between 0.10µM and 8.86µM with a mean concentration of 1.67µM. *Pseudo-nitzschia*, a genus of diatom that has been known to produce toxic algal blooms, was encountered in Buzzards Bay at Station 8. It is not known if the toxic species occurs in Buzzards Bay. Additionally, the dinoflagellate *Alexandrium tamarense*, which can produce paralytic shellfish poisoning toxins, was found frequently at Station 8 in abundances in the “range of thousands” of cells per liter (Turner *et al* 2000). Based on lower salinities, higher chlorophyll *a* concentrations, and anecdotal information of “green blobs of phytoplankton”, Turner *et al.* (2000) speculate that water flow/circulation is reduced in the inner harbor due to the Hurricane Barrier.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at four stations in New Bedford Inner Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). New Bedford Inner Harbor received an average (1997-2001) Health Index Score of 44.4 (fair) (CBB Undated b). Principle sources of nitrogen to this system are the Fairhaven WWTP and the City of New Bedford CSOs. The Hurricane Barrier contributes to degraded water quality by reducing tidal flushing and allowing the build-up of nutrients and coincident phytoplankton blooms. Additionally soft organic rich sediments may also release nutrients to the water column in the summer (Howes *et al*. 1999).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|------------------------------|--------|-------------------|-------------------------|-------------|-----------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Revere Copper Products, Inc. | | | 42420101 | Rodman Pond | 0.08 | 0.08 | 0.07 | 0.08 |

* Excludes any authorized cranberry growers

There are 429.602 acres of cranberry bog open space in the New Bedford Inner Harbor subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 3.84 MGD. This estimate includes the estimate of water use for the upstream segment MA95-33.

NPDES SURFACE DISCHARGE SUMMARY

Revere Copper Products, Inc (MA0004821) is permitted (26 December 2000) to discharge plate mill cooling, hot breakdown mill, hot breakdown furnace, and hot roll mill discharge via internal outfall 004B; treated wastewater from sheet washing, plate washing, boiler condensate and chemical wastewater via internal outfall 002A; and 0.165 MGD of compressor cooling, furnace cooling, boiler condensate blowdown, and storm water via outfall 002 (includes discharges resulting from internal outfalls 002A and 004B) to the Acushnet River. The facility's whole effluent toxicity limit is LC₅₀= 50% effluent (outfall #002) with a temperature limit of 85°F. (Their prior permit also required whole effluent toxicity testing on outfall 004B). The permittee is also authorized to discharge storm water via outfall 004C.

The Town of Fairhaven (MA0100765) is permitted (21 March 2003) to discharge 5 MGD of treated sanitary wastewater via outfall 001 to the Acushnet River (New Bedford Inner Harbor). The facility's whole effluent toxicity limit is LC₅₀= 100% effluent. The Town of Fairhaven analyzed their effluent for Total Residual Chlorine (TRC) on 27 occasions between March 1996 and March 2002. All concentrations were below the MDL of the permit that was in effect (issued in 1989). While the 1989 permit allowed the effluent to be seasonally disinfected, the permittee is now required to install an ultraviolet ray (UV) disinfection system to meet the more stringent TRC limit of 107 µg/L MDL. Also, operational criteria of the existing facility need to be evaluated and implemented to reduce nitrogen levels to the maximum practicable extent.

The City of New Bedford (MA0100781) discharges via 12 CSOs to Buzzards Bay (meaning New Bedford Inner Harbor). The permit will expire 2 January 2004. Additionally, there are six storm drain outfalls that discharge to this segment.

Glen Petroleum Company (MA0003301) is permitted (25 December 1979) to discharge via outfall 001 to the Acushnet River. The permit includes secondary limits for oil & grease= 15mg/L.

Trio Algarvio Inc., a fish processing and aquaculture facility, (MA0110329) is permitted (20 March 1996) to discharge 0.15 MGD via outfalls 001 and 002 to New Bedford Inner Harbor. The permit includes secondary limits for BOD= 30 mg/L and TSS= 30 mg/L.

The following general storm water permits were issued by the EPA in October 2001 and will expire in October 2005:

DN Kelley & Son Inc. MAR05B654
Global Companies LLC MAR05B694

New Bedford and Fairhaven are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al.* 1996).

AQUATIC LIFE

Biology

The predominant shellfish species of New Bedford Inner Harbor is the quahog *Mercenaria mercenaria* with an estimated standing crop in 1998 of 110 million individuals (540,000 bushels). Soft-shelled clams (*Mya arenaria*), oysters (*Crassostrea virginica*) and slipper limpets (*Crepidula spp*) were also present (DMF 1999).

As part of the New Bedford Harbor Long Term Monitoring Program, EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probabilistic sampling design at 27 hexagonal segments with approximately 30 stations per segment throughout the upper, lower, and outer harbor areas. In 1993, the first baseline sampling period, the middle harbor (this segment) exhibited signs of a stressed ecosystem and significantly impacted benthic community based on dominant opportunistic species (Nelson *et al* 1996). Bioaccumulation studies of PCBs in tissue using the blue mussel, *Mytilus edulis*, and the mummichog, *Fundulus heteroclitus*, have been conducted as part of the NBH-LTR since 1994. Mussels and mummichogs from the middle harbor showed decreased levels of PCBs when compared to the upper harbor. Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing these data and it is expected to be available for review in 2003 (Nelson 2003).

Habitat and Flow

The Inner Harbor has an average depth of six feet around the periphery and up to 30 feet in the navigation channels. The natural channeling seems to occur north to south with the major flow passing along the New Bedford side. Natural and manmade obstructions (i.e., the Hurricane Barrier) significantly affect the flushing and tidal exchange within the estuary. All of the creeks and streams that flowed into the Harbor have been routed through culverts (DMF 1999).

ASA was contracted by New England Interstate Water Pollution Control Commission and EPA to perform a flushing study of the Acushnet River estuary (New Bedford Inner Harbor). As part of the project, a dye study was undertaken in October 2001 to estimate residence time of wastewater discharged from the Fairhaven WWTP. Water elevations measured at the Coggeshall Street Bridge were dominated by semi-diurnal tides and varied at a fortnight cycle. The residence time of the Fairhaven WWTP effluent in New Bedford Inner Harbor was estimated to be less than 22 hours. Using three methods (freshwater exchange method, modified tidal prism method, and boundary fitted pollutant transport model numerical simulation) flushing time was estimated to be between 11 and 19 days. As freshwater inputs increased, flushing time decreased to between 6 and 18 days (ASA 2002b).

Toxicity-water

Effluent

Between March 1996 and June 2002, the Town of Fairhaven conducted 26 whole effluent toxicity tests using mysid shrimp, *Mysidopsis bahia*, and inland silversides, *Menidia beryllina*. There was no acute toxicity detected in any of the tests (LC₅₀'s ranged from >73 to >100% effluent).

Revere Copper Products Inc. (MA0004821) conducted 12 whole effluent toxicity tests on effluent from outfall 002 using the test organism *M. bahia* between March 1997 and September 2002 and four tests using the test organism *M. beryllina* between March 2001 and September 2002. No acute whole effluent toxicity was detected (LC₅₀'s >100% effluent). Between March 1997 and September 2000, eight whole effluent toxicity tests were also conducted on effluent from outfall 004B. No acute toxicity to mysid shrimp (*M. bahia*) was detected (LC₅₀'s > 100% effluent).

Ambient

Water from New Bedford Inner Harbor was collected near a small sandy beach (off of South Street, Fairhaven) approximately 500 feet from the Fairhaven WWTP outfall location for use as dilution water in their whole effluent toxicity tests. In the 26 tests conducted between March 1996 and June 2002, survival (exposed 48-hours) of *M. bahia* was not less than 95% and survival (exposed 48-hours) of *M. beryllina* was not less than 85%.

Toxicity-Sediment

As part of the NBH-LTM program sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on 27 sediment samples from the lower harbor. Average percent survival of test organisms exposed to sediment from the lower harbor was 66% (Nelson *et al* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Chemistry-water

Water from Inner New Bedford Harbor was collected for use as dilution water in the Town of Fairhaven whole effluent toxicity tests. These data, maintained in the MA DEP TOXTD database, from the 26 sampling events are summarized below.

Salinity

Salinity measurements reported by ASA as part of the flushing study ranged between 12 and 32 ppt with a negative gradient downstream. Salinity change with depth was very small, but variations existed near the surface (ASA 2002b)

pH

pH in New Bedford Inner Harbor ranged from 7.05 to 7.98 SU (TOXTD).

Alkalinity

Alkalinity in New Bedford Inner Harbor ranged from 40 to 107mg/L (TOXTD).

Total Suspended Solids:

Total suspended solids concentrations in New Bedford Inner Harbor ranged from 12 to 256 mg/L (TOXTD).

Ammonia (as N)

Ammonia concentrations ranged from <MDL to 0.980 mg/L (TOXTD). (No comparison to water quality criteria were conducted due to a lack of temperature data.)

Chemistry-sediment

As part of the NBH-LTM Program, numerous sediment samples were collected from the top 2 cm of New Bedford lower harbor at 27 sites using a Young-modified van Veen grab sampler, composited, and analyzed for 18 PCB congeners, TOC, and AVS (acid volatile sulfide), and nine metals (Ni, Pb, Cd, Cu,

Zn, Hg, As, Se, Cr) at a total of 27 stations in this segment. Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

From Nelson *et al* 1996. Average metal and total PCB concentrations (in µg/g dry wt) in the lower harbor sediment from 1993. N (the number of stations in the segment) = 27. S-EL (severe effect level) and L-EL (low effect level) from Persaud *et al* 1993 in µg/g dry wt.

| Parameter | Average Concentration | S-EL | L-EL |
|------------|-----------------------|------|------|
| As | 5.3 | 33 | 6 |
| Cd | 12 | 10 | 0.6 |
| Cr | 190 | 110 | 26 |
| Cu | 450 | 110 | 16 |
| Hg | 0.40 | 2 | 0.2 |
| Ni | 11 | 75 | 16 |
| Pb | 130 | 250 | 31 |
| Se | 0.42 | NA | NA |
| Zn | 260 | 820 | 120 |
| Total PCBs | 8.2 | 530 | 0.07 |

The *Aquatic Life Use* is assessed as impaired because of historic PCB contamination. It should be noted that remediation activities are underway and are being monitored closely by EPA. Additional concerns for New Bedford Inner Harbor include reduced tidal flushing and elevated nutrient levels.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

Area I (which encompasses this entire segment)—The general public should refrain from consuming all fish and lobster from this area (#191).

Based on the MPDH fish/seafood consumption advisory for New Bedford Inner Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB15.1 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired for this entire segment

PRIMARY AND SECONDARY CONTACT RECREATION

DMF noted that coliform levels are high following significant rain events and that during the winter counts were higher which may be attributed to the Fairhaven WWTP discharge which is not chlorinated in the winter. The Town of Fairhaven has implemented a new wharf and marina management plan to address potential sources of bacteria (DMF 1999).

According to the 1990 Facilities Plan for New Bedford, the Inner Harbor received an average of 50 CSO discharges per year (595 million gallons) and 1,308 MG of separate storm water discharges (CDM 1990). New Bedford has examined every CSO and has repaired and/or attempted to eliminate malfunctions. Additionally, New Bedford has undertaken projects that include upgrading the WWTP, reconstructing two pump stations, and conducting an inflow and infiltration study. It should be noted that the City of New Bedford has eliminated the CSO on the north side of the Coggeshall Street bridge, the CSO at Kenyon Street at North Front Street, which used to discharge to drainage swale, and the CSO at Pearl Street through the redirection of flows and the installation of new sewers. Additionally, the overflow structure at Wamsutta Street at Acushnet Avenue and the interceptor were eliminated. A new force main was constructed and is tied in to a new pump station (Furtado 2003).

DMF noted that two storm drains in the vicinity of the Gifford Street and Coggeshall Street exhibited elevated levels of fecal coliform bacteria. (These were referred to the DPW for further investigation and remediation.)

Major waterfowl populations near Marsh Island, Palmer's Island and the fish processing plants were also noted. (DMF1999).

Because of the active CSO discharges and the poor aesthetic quality, the *Primary* and *Secondary Contact Recreational* uses are assessed as impaired. It should be noted, however, that bacterial source reduction activities are ongoing and should result in improved conditions.







AESTHETICS

Massachusetts Community Water Watch conducted monthly shoreline surveys at the Coggeshall Street bridge between October 1999 and April 2000. MCWW noted five pipes and two natural springs draining to this segment. One pipe north of the causeway had a milky-gray runoff with an oily sheen and was only uncovered during low tide. Trash is very heavy and is a "huge eye-soar". Styrofoam cups, plastic bags, tires, a bicycle, a shopping cart, and metal signposts were noted (MCWW 2000).

The DMF sanitary survey noted abundant debris and runoff, CSOs, waterfowl, flowing storm drains and other discharge pipes, fish offal from fish processing plants, oil sheens/spills, hull paint scrapings. During the DMF sanitary survey there was a 200-gallon oil spill. A number of derelict vessels are "stored" near Herman Melville Boat Yard (DMF 1999). EPA since removed the abandoned vessels as part of the New Bedford Superfund remediation.

Based on the abundance of trash and debris, objectionable odors, oil sheens, and the CSO discharges, this segment of the Acushnet River is assessed as impaired for the *Aesthetics Use*.

New Bedford Inner Harbor (MA95-42) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|----------|---|--|---|---|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | PCB | Reduced tidal flushing, total nitrogen | Contaminated sediments, CERCLA NPL (Superfund site) | Changes in tidal circulation/flushing, CSO, urbanized high density area, municipal point source discharge |
| Fish Consumption |  | IMPAIRED | PCB | | Contaminated sediments, CERCLA NPL (Superfund site) | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria, PCB | | CSO, urbanized high density area, contaminated sediments, CERCLA NPL (Superfund site) | Waterfowl |
| Primary Contact |  | IMPAIRED | Oil & grease, odor, and, trash and debris | | CSO, urbanized high density area | Waterfowl |
| Secondary Contact |  | IMPAIRED | Oil & grease, odor, and, trash and debris | | CSO, urbanized high density area | Waterfowl |
| Aesthetics |  | IMPAIRED | Oil & grease, odor, color, trash and debris | | CSO, urbanized high density area | Ship building, repairs, drydocking, ballast water releases |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS NEW BEDFORD INNER HARBOR (MA95-42)

- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.
- Implement recommendations outlined in the Massachusetts Water Watch Shoreline Survey report to improve the aesthetics.
- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.
- Review and implement the Town of Fairhaven Wastewater Treatment Plant study to reduce nitrogen levels to the maximum practicable extent as required by the NPDES permit issued March 2003. Continue to monitor toxicity test results and compliance as part of the *Aquatic Life Use* assessment.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and if deemed necessary, to increase spatial and temporal coverage of *in-situ* monitoring. Review final reports to assess the *Aquatic Life Use*.
- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including CSO abatement actions (e.g., elimination of cross connections and/or CSO outfalls), treatment of storm water discharges, and the Phase II community storm water management programs and to assess the recreational uses.
- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program and develop a Long-Term CSO Control Plan which will achieve compliance with the water quality standards for the *Aquatic Life Use* and recreational uses.
- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.
- Implement the DMF *Sanitary Survey of New Bedford/Fairhaven Inner Harbor (BB: 15.1)* report recommendations listed below to improve the water quality and reopen shellfish beds (Whittaker 1999). Continue to review shellfish status reports to assess the *Shellfish Harvesting Use*.
 - The City of New Bedford & Town of Fairhaven should establish a pollution abatement plan concentrating on education and regulation directed toward the fishing and recreational fleets.
 - CSO and storm drains that have been compromised by illegal use or structural malfunctions should be addressed immediately.
 - The practice of fish processing houses discarding fish offal and other materials into the harbor should be stopped immediately.
 - If construction of additional openings in the hurricane barrier is considered to improve flushing, the action should be preceded by water quality improvements to the Inner Harbor to avoid deleterious impact on the productive shellfish beds of the Outer Harbor.
- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are NB04, NB05, NB06, NB07, and NB08. Develop a plan to monitor the effectiveness of the restoration and improvements in water quality and subsequent affects on the aquatic life.

OUTER NEW BEDFORD HARBOR (SEGMENT MA95-63)

Location: From the Hurricane Barrier, Fairhaven/New Bedford to a line drawn from Wilbur Point, Fairhaven to Clarks Point, New Bedford

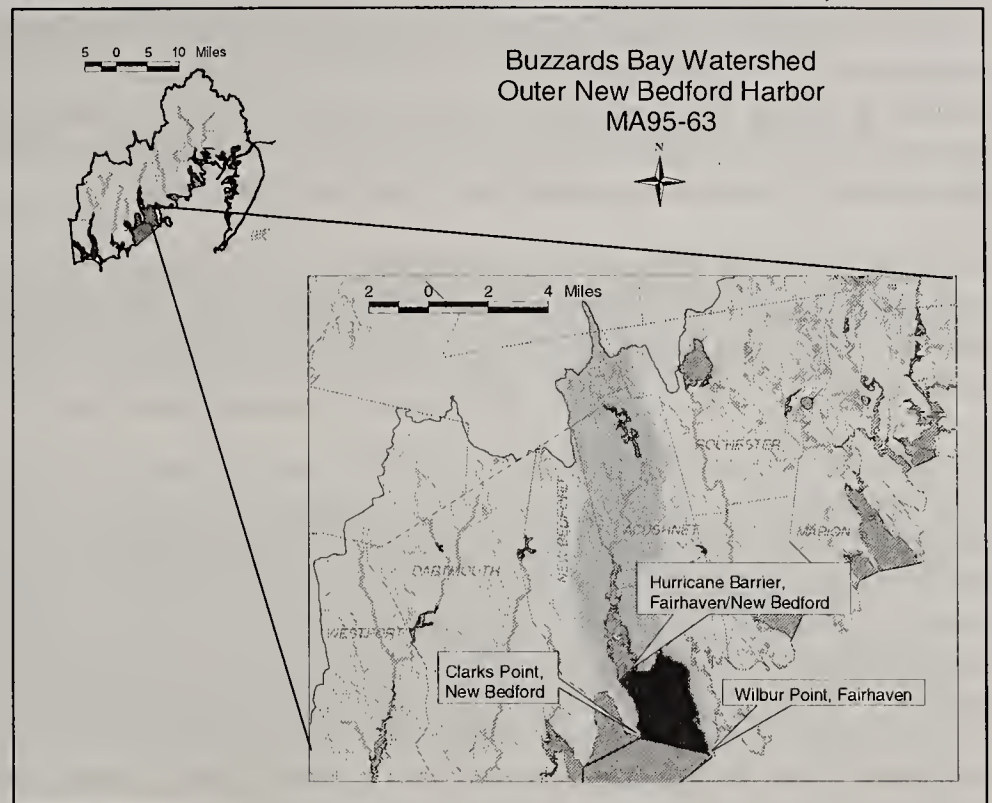
Segment Area: 5.82 square miles

Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 29.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 37% |
| Residential | 30% |
| Open Land | 13% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters (as segment MA95-27) as not meeting the water quality standards for priority and nonpriority organics, metals, organic enrichment/low DO and pathogens (MA DEP 1999). As part of the Massachusetts Estuaries Project, a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Acushnet/New Bedford Harbor System which also encompasses this segment.



There is public access to Outer New Bedford Harbor at two locations along East Rodney French Boulevard. A concrete boat launch with parking for 30 trailers is maintained by the City (DFWELE 2 July 2002). At the mouth of New Bedford Harbor is one of the smaller parks in Massachusetts. Fort Phoenix State Reservation combines historic features, scenic views and a variety of recreational facilities. Minutes from downtown New Bedford, the park contains a half-mile of Buzzards Bay beachfront. Adjacent to the park (and managed by the Town of Fairhaven) is Fort Phoenix, the national landmark Fort from which the park gets its name. From the ramparts remnants one can gaze across the bay to where the first naval battle of the Revolutionary War was fought and to the rolling meadows of the Elizabeth Islands. (MA DEM Undated a)

The 18,000-acre New Bedford site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs while producing electric devices from 1940 to the late 1970s, when the use of PCBs was banned by the EPA. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the city's sewerage system. As a result, the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay (EPA 13 February 2003).

ACOE completed dredging of the hotspot portions of the New Bedford Superfund Site in 1995 and removed 14,000 cubic yards of sediments. Remediation of the remainder of the harbor involves dredging 500,000 cubic yards of sediments from the estuary and outer harbor. Facilities to treat harbor water pumped during dredging were scheduled to be built in 2002, ComElectric's power cables were relocated in 2003, a CSO was relocated in May 2001, and 16 abandoned and sunken vessels in contaminated soil were removed (ACOE 31 January 2002).

ACOE is assisting CZM in the preparation of a Dredged Material Management Plan for maintenance dredging of the navigation channels in New Bedford and Fairhaven harbors. The Fairhaven side would require dredging of approximately 70,000 cubic yards of shoal material. The main deep-draft channel has an authorized depth of 30 feet and would require removing 1.3 million cubic yards of material to restore the authorized dimensions. However, navigation traffic projections do not at this time demonstrate a need

for dredging those areas. CZM is in the processes of developing an Environmental Impact Report that would recommend options for the disposal of dredge materials (ACOE 31 January 2002).

ASA is conducting a water quality assessment of Outer New Bedford Harbor to evaluate sources and distribution of fecal coliform bacteria. Initial results indicate high concentrations near the Hurricane Barrier and near Boys and Girls Creek. ASA will utilize models to simulate fate and transport of fecal coliform bacteria in the harbor and use DNA (Deoxyribonucleic acid) fingerprinting techniques to determine if the sources are animal or human (ASA 2002a).

ACOE is assisting EPA with a bioavailability study of Boy's Creek tidal marsh involving soil investigations and ecological investigations as part of the Atlas Tack Superfund Site Remediation in Fairhaven. ACOE also will develop a scope of work for excavation and restoration of the upland and marsh soils and sediments.

In 1998 the Buzzards Bay Project and the Town of Fairhaven were awarded a s. 319 grant by the MA DEP Nonpoint Source Program to restore salt marsh habitat to Winsegansett Salt Marsh in the New Bedford Harbor Subwatershed. Winsegansett Salt Marsh is a 30-acre coastal wetland system connected to outer New Bedford Harbor through a series of tidal creeks and is located on the western shore of Sconticut Neck in Fairhaven. Tidal flows in the marsh were restricted by the culverting of the creek under Winegansett Avenue prior to 1956. Reduced tidal flows can alter the water quality within the marsh (e.g., reduced salinity, reduced flushing) thereby reducing diversity and biomass, especially among the plant communities. In Winsegansett Salt Marsh reduced tidal flow led to the proliferation of the non-native nuisance plant *Phragmites australis*, the common reed, which tolerates lower salinity habitats. The project replaced the 18-inch culvert under Winegansett Avenue with two 30-inch concrete arch culverts. Additionally, three culverts under private footpaths were also replaced with two 24-inch ADS plastic culverts. EPA/NOAA Five Star Restoration Challenge Grant funds, FishAmerica Foundation Grant money, and Buzzards Bay Project Municipal Grant Program money were also used to complete this project. The Buzzards Bay Project conducted pre-construction monitoring of salinity, pH, and vegetation distribution/abundance (% cover, stem density, flower density, plant height) on four occasions in 2000 and five occasions in 2001 at seven stations. Post-construction monitoring was conducted in 2002 (BBP 1999-2002).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in New Bedford Outer Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at five stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). New Bedford Outer Harbor received an average (1997-2001) Health Index Score of 68.8 (good/excellent) (CBB undated b). The Fairhaven WWTP and New Bedford CSOs were listed by CBB as the principle sources of nitrogen to this system. The Hurricane Barrier also contributes to degraded water quality by reducing tidal flow and accumulating organic rich sediments that release nutrients to the water column in the summer (Howes *et al* 1999).

WMA WATER WITHDRAWAL (APPENDIX F)

There are 429.602 acres of cranberry bog open space in the Outer New Bedford Harbor subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 3.84 MGD including the estimated water use for the upstream segments MA95-38 and MA95-42.

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0100781) discharges via seven CSOs to Buzzards Bay Outer Harbor (outfalls 012-018). The permit will expire 2 January 2004.

The City of New Bedford (MA0034428) is permitted (24 June 1992) to discharge storm water via outfalls 042-044 to Clark's Cove and Outer New Bedford Harbor. The permit expired in 1997.

Cornell-Dubilier Electronics Corporation (MA00003930) is permitted (28 February 2001) to discharge storm water via outfall 002 to Fort Phoenix Reach near the Acushnet River Estuary in Lower New Bedford

Harbor. The permit will expire in 2006. Cornell-Dubilier Electronics operated a capacitor manufacturing operation. From the 1940s-1978 the facility released PCB contaminated wastewater onto shoreline mudflats and into New Bedford Harbor. The facility was required to monitor storm water discharges at the site due to residual PCB contamination. (See Sources of Information for additional information.)

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:

Allegheny Rodney MAR05C155

New Bedford and Fairhaven are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al* 1996).

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Outer New Bedford Harbor from historic 1951 black and white aerial photography. Eelgrass beds in Outer New Bedford Harbor were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). Eelgrass beds have declined along the eastern shore of this segment near Sconticut Neck and have been lost between the Fort Phoenix Beach State Reservation and Harbor View (Farmfield Lane).

Biology

As part of the New Bedford Harbor Long Term Monitoring Program, EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probabilistic sampling design at eight hexagonal segments with approximately 30 stations per segment throughout the outer harbor area. In 1993, the first baseline sampling period, the outer harbor (this segment) can "generally be classified as healthy, based on high species richness, positive EMAP benthic index, and even distribution of the dominant species" (Nelson *et al* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Toxicity

Ambient

Between March 2001 and October 2002, water was collected from the Harbor approximately 20 yards north of the concrete pier on the eastern shore of Clarks Point for use as dilution water in the City of New Bedford WWTP's whole effluent toxicity tests. Survival of *M. bahia* (exposed 48-hours) was good (88-100%) and survival of *M. beryllina* (exposed 7-days) was good (85-100%).

Toxicity-Sediment

As part of the NBH-LTM program in 1993, sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on eight sediment samples from the outer harbor. Average percent survival from the outer harbor was 91% with only one sample showing acute toxicity (Nelson *et al* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Chemistry – water

Water was collected from the Harbor approximately 20 yards north of the concrete pier on the eastern shore of Clarks Point for use as dilution water in the City of New Bedford WWTP's whole effluent toxicity tests. These data, maintained in the TOXTD database, are summarized below.

pH

pH ranged from 7.4 to 8.06 SU.

Ammonia-Nitrogen (as N)

Ammonia concentrations ranged from BDL to 8.66 mg/L. (No comparison to water quality criteria was conducted because of the lack of temperature data.)

Total Suspended Solids

TSS ranged from 32 to 62 mg/L.

Chemistry-sediment

In 1993, as part of the NBH-LTM Program, numerous grab samples sediments were collected from the top 2 cm of New Bedford outer harbor at 23 sites using a Young-modified van Veen grab sampler, composited, and analyzed for 18 PCB congeners, TOC, AVS (acid volatile sulfide), and nine metals (Ni, Pb, Cd, Cu, Zn, Hg, As, Se, Cr). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

From Nelson *et al* 1996. Average metal and total PCB concentrations (in µg/g dry wt) in the outer harbor sediment from 1993. N (the number of stations in the segment) = 23 (includes sediment samples from Clarks Cove and Open Water). S-EL (severe effect level) and L-EL (low effect level) from Persaud *et al* 1993 in µg/g dry wt.

| Parameter | Average Concentration | S-EL | L-EL |
|------------|-----------------------|------|------|
| As | 3.1 | 33 | 6 |
| Cd | 0.28 | 10 | 0.6 |
| Cr | 19 | 110 | 26 |
| Cu | 19 | 110 | 16 |
| Hg | 0.07 | 2 | 0.2 |
| Ni | 5.3 | 75 | 16 |
| Pb | 18 | 250 | 31 |
| Se | 0.23 | NA | NA |
| Zn | 42 | 820 | 120 |
| Total PCBs | 0.83 | 530 | 0.07 |

Because of eelgrass bed habitat loss the *Aquatic Life Use* is assessed as impaired. This loss may be associated with nutrient enrichment from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include the CSO discharges, urbanized high density areas, recreational activities (boating and swimming), and storm water.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

Area II (which encompasses this segment)—The general public should refrain from consuming lobster from this area (#4949).

Based on the MPDH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB15.41, BB15.42, BB15.43, BB15.51 are prohibited and BB15.52, BB15.6, and BB15.7 are restricted (DFWELE 2000).

Shellfish growing areas BB15.4 and BB15.5 were classified as conditionally approved in the July 2000 status report, but have recently been reclassified as restricted (Whittaker 2003).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

PRIMARY AND SECONDARY CONTACT RECREATION







MA DEM collected weekly *Enterococci* bacteria samples from the beach at Fort Phoenix State Reservation between May and August 2002 (n=16) (MA DEM 2002). The MA DEM Beach at Fort Phoenix was closed to swimming because of elevated *Enterococci* bacteria levels between 8/21-8/23/2001 and again between 7/9-7/10/2002 (MDPH 2002).

Additionally, the following beaches were closed to swimming based on elevated *Enterococci* levels: public beach at Manhattan Avenue was closed between 8/21-8/24/2001 and the semi-public beach was closed between 7/10-7/17/2001; the Reservation Road beach was closed 8/21-8/24/2001; and the Silvershell Beach (Chamber Street) was closed between 8/21-8/24/2001 (MDPH 2002b).

New Bedford Outer Harbor received an average of 49 combined sewer overflows per year (595 million gallons) according to the 1990 CDM facilities plan. New Bedford Outer Harbor also received 256 MG of separate storm water discharge (CDM 1990). The City of New Bedford has eliminated CSO discharges at Apponagansett Street, Gifford Street, Butler Street at East Rodney French Boulevard, Cove Street at East Rodney French Boulevard, and Ricketson Street through the redirection of flows and installation of new sewers (Furtado 2003).

While the bathing beaches in this segment have rarely been closed, the presence of CSOs and the number and volumes of past discharges are of concern. Therefore, it is best professional judgment that this segment is currently not assessed. This segment is, however, identified with an Alert Status.

New Bedford Outer Harbor (MA95-63) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|--------------|--|---|---|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (decline/loss of eelgrass bed habitat) | Total nitrogen, other anthropogenic substrate alterations | | CSO, urbanized high density area, municipal separate storm sewer systems |
| Fish Consumption |  | IMPAIRED | PCBs | | Contaminated sediments, CERCLA NPL (Superfund site) | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | | Unknown | Municipal separate storm sewer systems |
| Primary Contact** |  | NOT ASSESSED | | | | |
| Secondary Contact** |  | NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

** Alert Status Issues identified—see details in use assessment section.

RECOMMENDATIONS NEW BEDFORD OUTER HARBOR (MA95-63)

- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.
- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.
- Implement the seven salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town of Fairhaven. Sites in this subwatershed are located along the western side of Sconticut Neck and labeled FH08, FH20, FH21, FH21a, FH22, FH23, and FH24. Develop a plan to monitor the effectiveness of the restoration and improvements in water quality as it relates to the *Aquatic Life Use*.
- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program, and develop a Long-Term CSO Control Plan which will achieve compliance with the water quality standards.
- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.
- Design and conduct a bacteria survey to assess the recreational uses. Consider bracketing point and nonpoint source discharges to determine the effectiveness of the CSO reduction activities and Phase II storm water activities.

CLARKS COVE (SEGMENT MA95-38)

Location: The semi-enclosed waterbody landward of a line drawn between Clarks Point, New Bedford and Ricketsons Point, Dartmouth
Segment Area: 1.90 square miles
Classification: Class SA, Shellfishing (Open), CSO

The drainage area of this segment is approximately 3.3 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Residential | 65% |
| Open Land | 17% |
| Forest | 8% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for priority organics, and pathogens (MA DEP 1999). As part of the Estuaries Project a nutrient and bacteria TMDL will be developed in the next few years for the Acushnet/New Bedford Harbor System that encompasses this segment.

There is public access to Clark Cove via one City-maintained concrete boat launch with parking for 22 trailers (DFWELE 2 July 2002).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in Clarks Cove between May and September from 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at four stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Clarks Cove contains one of the "most significant quahog fisheries in Buzzards Bay". The City of New Bedford has done extensive work on its CSOs in Clarks Cove, although in 1999 seven were still discharging. Eelgrass beds are expanding in this segment (Howes *et al.* 1999). High transparency, low nitrogen levels, sporadic plankton blooms, and rare instances of oxygen depletion are apparent in the average (1997-2001) Health Index scores for Inner Clarks Cove and Outer Clarks Cove, 76.9 and 81.8, respectively (both good/excellent) (CBB undated b).

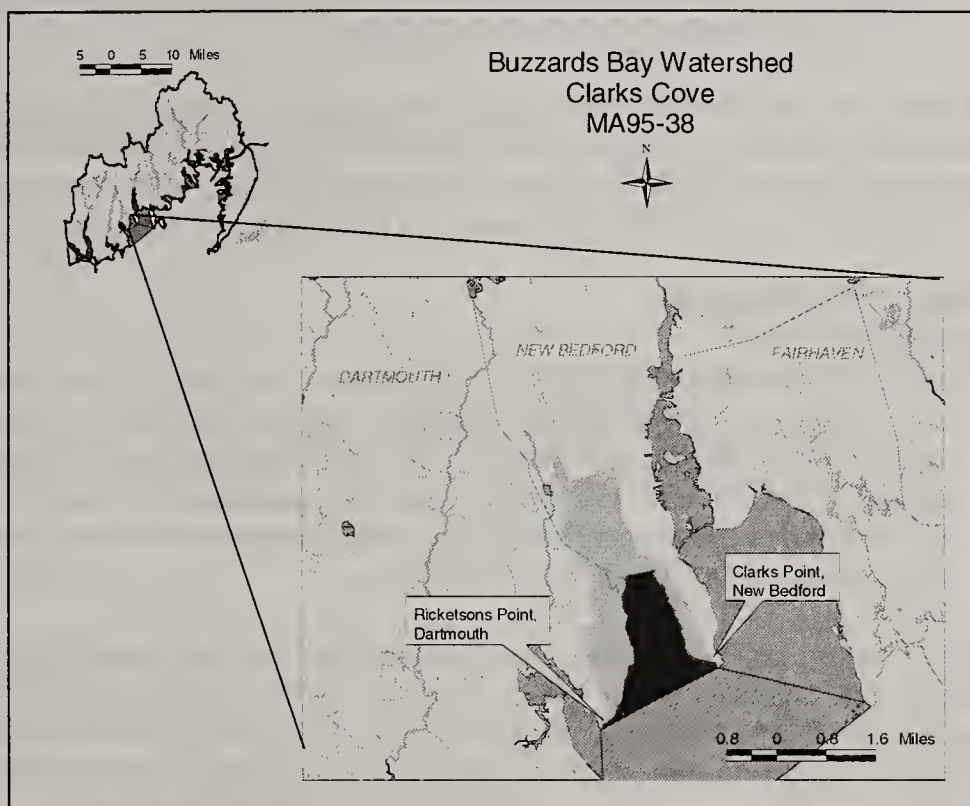
As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 at two segments in Clarks Cove with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al.* 1996). EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

WMA WATER WITHDRAWAL

There are no known regulated water withdrawals from this subwatershed.

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0034428) is permitted (24 June 1992) to discharge site dewatering discharges via outfalls 045, 046, and 047 to Clark's Cove and storm water via outfalls 042-044 to Clark's Cove and Outer New Bedford Harbor. The permit expired in 1997.



The City of New Bedford (MA0100781) discharges via nine CSO locations to Clark's Cove (outfalls 003-011). The permit will expire 2 January 2004.

Dartmouth and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

MA DEP identified the presence of eelgrass in Clarks Cove from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Clarks Cove were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 1994 aerial photography determined that the eelgrass bed identified in 1951 along the eastern shore near Clarks Point and along the western shore near Mashers Island and Ricketsons Point appear to be declining slightly. Eelgrass bed mapping was not conducted in Clarks Cove in 2002.

Since recent (2002) eelgrass bed habitat data are not available, the *Aquatic Life Use* is currently not assessed. This use is identified, however, with an Alert Status as the decline of eelgrass bed habitat may be indicative of reduced water clarity or nutrient enrichment from anthropogenic activities. Nitrogen thresholds and habitat quality guidelines are currently being developed by the Massachusetts Estuaries Project to better evaluate the status of the *Aquatic Life Use*.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

Area II (which encompasses this segment)—The general public should refrain from consuming lobster from this area (#4949).

Based on the MDPH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB13.1, BB13.20, BB13.21, and BB13.22 are conditionally approved; BB13.3, BB13.4 and BB13.6 are restricted; and BB13.5 and BB13.7 are prohibited (DFWELE 2000). Shellfish growing areas BB13.3 and 13.4 have been reclassified as prohibited (Whittaker 2003).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.







PRIMARY AND SECONDARY CONTACT RECREATION

Hidden Bay Beach, a semi-public beach in Dartmouth was closed between 6/6-6/14/2001 and again between 8/20-8/24/2002 due to elevated *Enterococci* levels (MDPH 2002b).

According to the 1990 CDM Facilities Plan for New Bedford, Clark Cove received an average 496 million gallons of CSO per year and CSOs discharged an average of 45 times per year. Additionally, Clark Cove received 286 MG of separate storm water discharges (CDM 1990). However, the City of New Bedford has since done extensive work on its CSOs in Clarks Cove. As of 1999 seven were still discharging. In the Clarks Cove area, more than 500 homes were dye tested, resulting in the identification of numerous cross connections. The City of New Bedford corrected these cross connections and eliminated the CSO at Seymour Street. Additionally, the City undertook an approximately four million dollar renovation project of its collection system in the Clarks Cove area including the installation of two new pump stations, two new interceptors, and sewer separation work that has greatly reduced CSO activity. The New Bedford Wastewater Treatment Plant was also upgraded, increasing capacity, thereby further reducing CSO activity (Furtado 2003).

Too little data are currently available so the *Contact Recreational Uses* are both not assessed. These uses are identified with an Alert Status, however, because of the presence of the CSO discharges.

Clarks Cove (MA95-38) Use Summary Table

| Designated Uses | | Status | Causes | Sources |
|-----------------------|--|--------------|-------------------------|--|
| | | | Known | Known |
| Aquatic Life |  | NOT ASSESSED | | |
| Fish Consumption |  | IMPAIRED | PCBs | Contaminated sediments, CERCLA NPL (Superfund site) |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | CSO, urbanized high density area, municipal separate storm sewer systems |
| Primary Contact** |  | NOT ASSESSED | | |
| Secondary Contact** |  | NOT ASSESSED | | |
| Aesthetics |  | NOT ASSESSED | | |

*For watershed-wide shellfish growing area data see Appendix E.

** Alert Status issues identified see details in assessment section.

RECOMMENDATIONS CLARKS COVE (MA95-38)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including CSO remediation/abatement activities, treatment of storm water discharges and the Phase II community storm water management programs and assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF sanitary survey and triennial reports to improve water quality and possibly reopen shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality and to assess the *Aquatic Life Use*.
- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.
- The City of New Bedford should continue efforts to complete a reassessment of their CSO abatement program, and develop a Long-Term CSO Control Plan which will achieve compliance with the water quality standards.
- The City of New Bedford should operate and maintain their sewer system to minimize the frequency and volume of CSO discharges by implementing the Nine Minimum Controls pursuant to federal and state CSO policies.
- Develop a nutrient/bacteria TMDL for the Acushnet River/New Bedford Harbor system in accordance with the Massachusetts Estuaries Project.

BUTTONWOOD BROOK (SEGMENT MA95-13)

Location: Headwaters, at Oakdale Street, New Bedford to mouth at Apponagansett Bay, Dartmouth

Segment Length: 3.8 miles

Classification: Class B

The drainage area of this segment is approximately 3.065 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Residential | 51% |
| Forest | 24% |
| Open Land | 14% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters, needing confirmation, as not meeting the water quality standards for pathogens (MA DEP 1999).

Buttonwood Brook is "a controlled stream which has been engineered to provide needed storm water management" and is cited as the major source of fecal coliform bacteria to Apponagansett Bay (Howes *et al* 1999). Buttonwood Park Zoo, located along the brook, was reopened in August 2000 upon completion of a ten million dollar renovation to the zoo facilities. Renovations included the demolition of a 400 linear foot concrete flume and re-routing this channel into a new watercourse. The new watercourse consists of earthen embankments, bordering wetlands and a vegetated buffer to keep the zoo animals from entering the watercourse (Gould 1998).

In 2000 the Coalition for Buzzards Bay began conducting water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Buttonwood Brook between May and September. Samples were collected between 6 and 9 am.





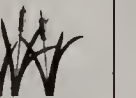
WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

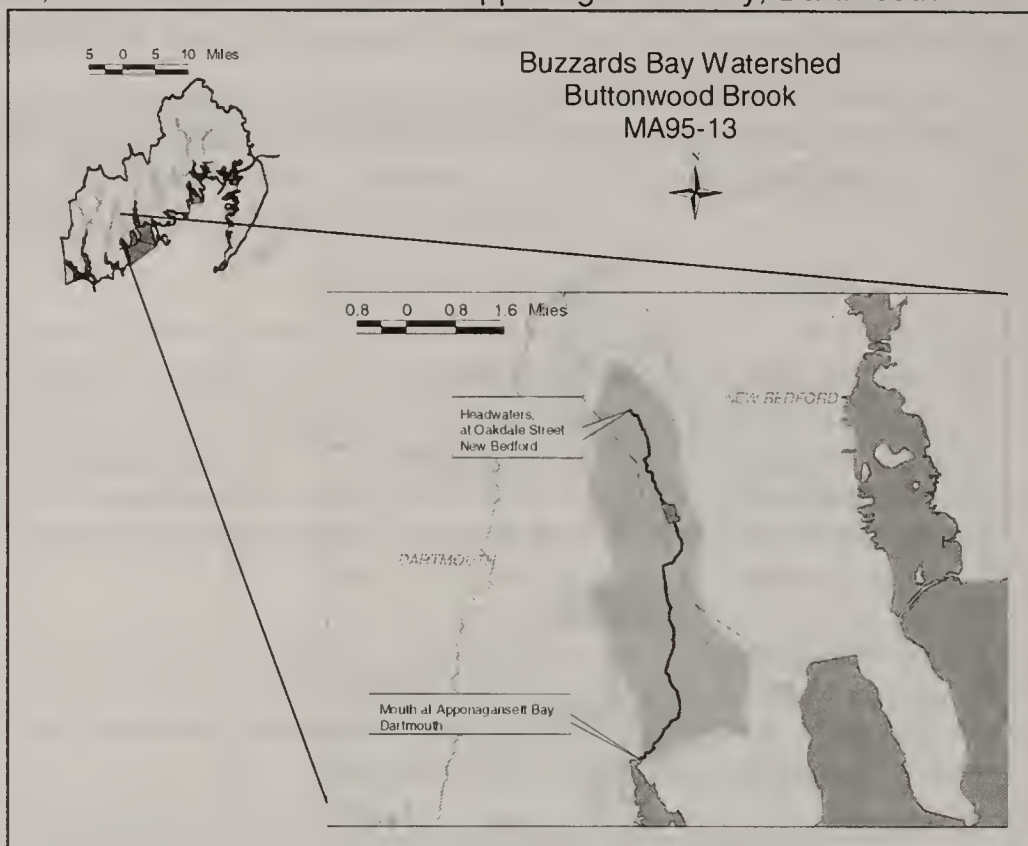
There are no regulated water withdrawals or wastewater discharges in this segment. It should be noted, however, that both Dartmouth and New Bedford are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

Due to the lack of current available data the designated uses for Buttonwood Brook are not assessed.

Buttonwood Brook (MA95-13) Use Summary Table

| Aquatic Life | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|--|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |



RECOMMENDATIONS BUTTONWOOD BROOK (MA95-13)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Develop a plan to monitor bacteria levels to document the effectiveness of bacteria source reduction activities including treatment of storm water discharges, improvements at Buttonwood Park Zoo and the Phase II community storm water management programs and to assess the recreational uses.
- Continue to support nonpoint source assessment activities within this subwatershed to identify the major pollutant inputs to Apponagansett Bay and then remediate those pollution sources. One such project is the City of New Bedford's storm water sampling project, which seeks to identify nutrient and bacteria sources in the upper reaches of Buttonwood Brook under a MA CZM Coastal Pollution Remediation Program grant. When complete, review the final report for information to assess the Primary and Secondary Contact Recreational uses.

APPONAGANSETT BAY (SEGMENT MA95-39)

Location: From the mouth of Buttonwood Brook, to a line drawn from Ricketsons Point, New Bedford to Samoset Street near North Avenue, Dartmouth

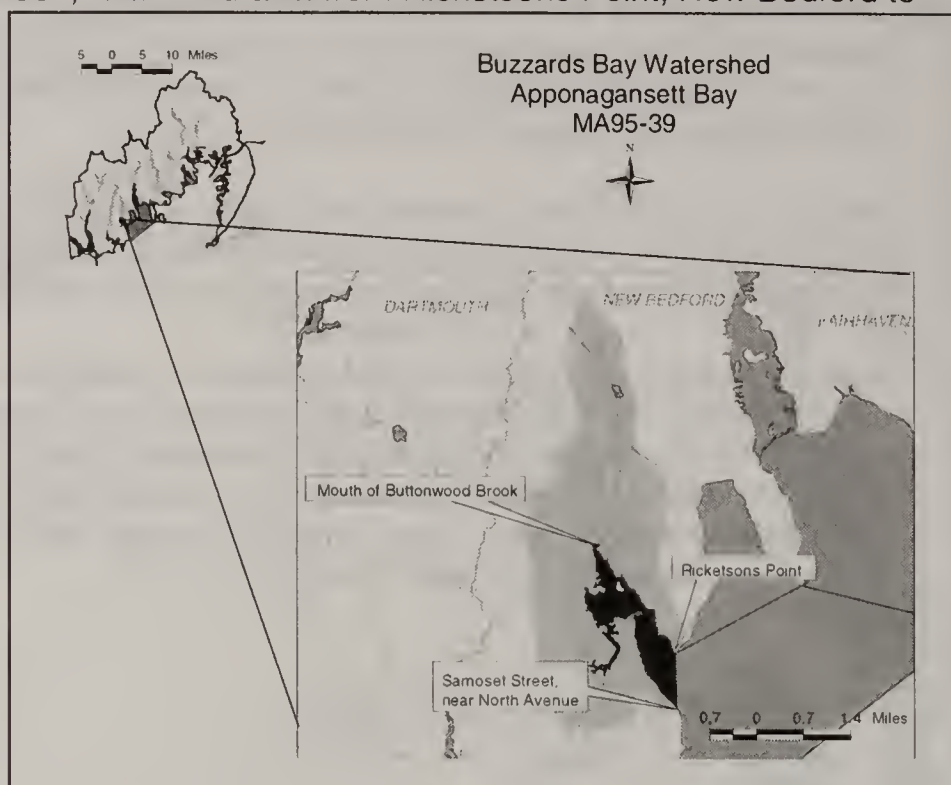
Segment Area: 0.95 square miles

Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 8.2 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Residential | 40% |
| Forest | 32% |
| Open Land | 10% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



There is public access to Apponagansett Bay via two asphalt boat launches maintained by the Town of Dartmouth. Sixty-six parking spaces are available at this site (DFWELE 2002). There are two vessel sewage pump-out boats (North Side Bridge Town Dock and Davis & Tripp's Marina) operating on Apponagansett Bay (Howes *et al.* 1999, BBP Undated, and DMF 29 January 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at six stations on Apponagansett Bay between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at seven stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al.* 1999). Nutrient inputs to Apponagansett Bay cited in the Baywatchers report include Buttonwood Brook and Buttonwood Park Zoo. Buttonwood Brook is "a controlled stream which has been engineered to provide needed storm water management" and is cited as the major source of fecal coliform bacteria to Apponagansett Bay. Apponagansett Bay exhibits "areas of anoxic bottom sediments consisting of fine organic-rich particles and periodic blooms of macroalgae (*Ulva lactuca* and *Gracillaria sp.*)". Eelgrass bed loss has been significant throughout the mid-1980s. Light penetration is poor; long-term means of Secchi disk depths are 1.27 m and 1.89 m. Water quality problems in Apponagansett Bay originate from the bay's hydrodynamics and inputs from septic systems, lawns, farmland, and other watershed inputs (Howes *et al.* 1999). Inner Apponagansett Bay received an average (1997-2001) Health Index Score of 26.5 (poor), Middle Apponagansett Bay received an average score of 54.9 (fair), and Outer Apponagansett Bay received an average score of 63.3 (fair) (CBB undated b).

WMA WATER WITHDRAWAL SUMAMRY (APPENDIX F)

There are 4.452 acres of cranberry bog open space in the Apponagansett Bay subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.04 MGD.

NPDES WASTEWATER DISCHARGE SUMMARY

Davis and Tripp Inc. (MAR05B657) was issued a general permit by the EPA in October 2001, which will expire in October 2005.

Dartmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

There is a tidal restriction at Bridge Street (the causeway connecting South Dartmouth to Padanaram Village). This restriction (Site DA01) has reduced tidal flow into upper Apponagansett Bay (BBP 2002b).

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Apponagansett Bay from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Apponagansett Bay were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 1999 aerial photography determined that the eelgrass bed north of Gulf Road had disappeared. However, the beds south of Gulf Road appear to be stable. Poor water clarity and the presence of sea lettuce (a macroalgae capable of creating nuisance conditions) have been documented by the Coalition for Buzzards Bay.

The *Aquatic Life Use* is currently not assessed for Apponagansett Bay. However, due to the decline of eelgrass bed habitat north of Gulf Road and the reduced water clarity and presence of macroalgae, this use is identified with an Alert Status. Decline in eelgrass bed habitat may be associated with nutrient enrichment and reduced water clarity. Suspected sources of nutrient enrichment in this subwatershed include septic systems, lawns, farmland, and other nonpoint source inputs as well as the tidal restriction.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

Area III (which encompasses this segment)—The general public should refrain from consuming all bottom fish, American eel, flounder, scup, and tatuog from this area (#4948).

Based on the MPDH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB12.5 and BB12.6 are approved; BB12.20, BB12.3, and BB12.7 are conditionally approved; and BB12.4 is prohibited (DFWELE 2000). Shellfish growing areas BB12.1 and BB12.2 have been reclassified from restricted to prohibited (Whittaker 2003).







Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 0.27 mi² and as impaired for 0.68 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

Bay View Beach in Dartmouth was closed from 6/25-7/1/2002 due to elevated *Enterococci* levels (MDPH 2002b).

Based on the more stringent shellfish harvesting guidelines, the *Primary and Secondary Contact Recreational Uses* are assessed as support for 0.27 mi². The remaining 0.68 mi² are currently not assessed.

Apponagansett Bay (Segment MA95-39) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|------------------------|---|---|-------------------------|-----------|---|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED | | | | |
| Fish Consumption |  | IMPAIRED | PCBs | | Contaminated sediments, CERCLA NPL (Superfund site) | |
| Shellfish Harvesting** |  | 0.27 mi ² SUPPORT 0.68 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | On-site treatment systems, urbanized high density area, municipal separate storm sewer systems |
| Primary Contact |  | 0.27 mi ² SUPPORT 0.68 mi ² NOT ASSESSED | | | | |
| Secondary Contact |  | 0.27 mi ² SUPPORT 0.68 mi ² NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

* Alert Status issues identified—see details in use assessment section

**For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS APPONAGANSETT BAY (MA95-39)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring to continue to evaluate the status of the *Aquatic Life Use*.
- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the ten salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are DA01, DA02, DA03, DA14, DA15, DA16, DA17, DA18, DA19, and DA20. The tidal restriction on the bridge at Gulf Road (Site DA02) is the seventh highest priority site in Buzzards Bay and the culvert at Old Road (Site DA17) is the ninth highest priority site. Develop a plan to monitor the effectiveness of the restoration and the improvements to water quality and affects on the aquatic life.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality to assess the *Aquatic Life Use*.
- Address NPS pollutant inputs into Apponagansett Bay to reduce shellfish bed closures. Continue to support nonpoint source assessment activities within this subwatershed to identify the major pollutant inputs to Apponagansett Bay and then remediate those pollution sources.

OPEN WATER OUTSIDE NEW BEDFORD HARBOR (SEGMENT MA95-62)

Location: Open water area encompassed within a line drawn from Wilbur Point, Fairhaven to Clarks Point, New Bedford to Ricketson Point, Dartmouth to East/Central Avenues, Dartmouth down to Round Hill Point, Dartmouth and back to Wilbur Point, Fairhaven

Segment Area: 8.02 square miles

Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 42.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

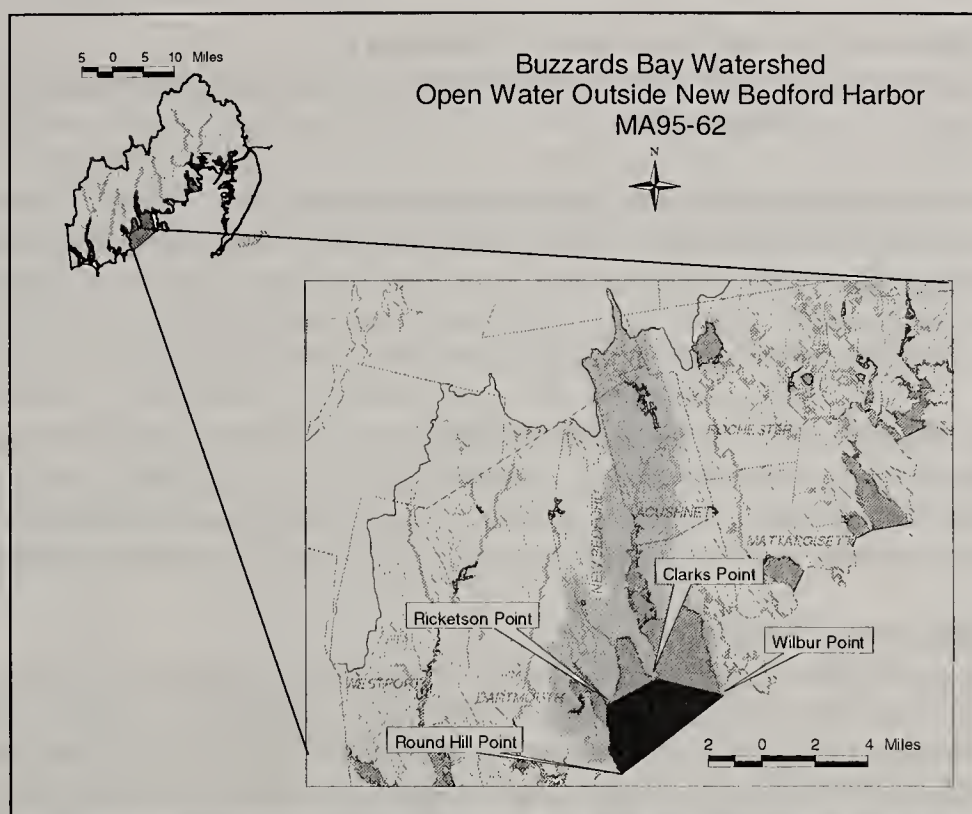
| | |
|-------------|-----|
| Residential | 35% |
| Forest | 34% |
| Open Land | 13% |

A portion of this segment (formerly part of MA95-27) is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for priority and nonpriority organics, metals, organic enrichment/low DO and pathogens (MA DEP 1999). The majority of this segment has never been assessed.

The 18,000-acre New Bedford site is an urban tidal estuary with sediments that are highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals. At least two manufacturers in the area used PCBs while producing electric devices from 1940 to the late 1970s, when the EPA banned the use of PCBs. These facilities discharged industrial wastes containing PCBs directly into the harbor and indirectly via the City's sewerage system. As a result the harbor is contaminated in varying degrees for at least 6 miles, from the upper Acushnet River into Buzzards Bay (EPA 12 February 2003).

ACOE is assisting CZM in the preparation of a Dredged Material Management Plan for maintenance dredging of the navigation channels in New Bedford and Fairhaven harbors. The Fairhaven side would require dredging of approximately 70,000 cubic yards of shoal material. The main deep-draft channel has an authorized depth of 30 feet and would require removing 1.3 million cubic yards of material to restore the authorized dimensions. However, navigation traffic projections do not at this time demonstrate a need for dredging those areas. CZM is in the process of developing an Environmental Impact Report that would recommend options for the disposal of dredge materials (ACOE 31 January 2002).

Dr. Jefferson Turner, students, and research associates at UMass Dartmouth have conducted 141 monthly cruises of Buzzards Bay between October 1987 and October 1998 to establish temporal and spatial trends of hydrography, water quality, and plankton community structure. Station 7, was located over the subsurface outfall of the primary treatment sewage plant of New Bedford, and was sampled for conductivity, temperature, dissolved oxygen, depth, Secchi disk depth, salinity, nutrients, chlorophyll *a* and phytoplankton. Salinity was "almost uniformly 30 ppt throughout the study at virtually all times". Mean surface temperatures at station 7 were below SWQS. The mean Secchi disk depth at station 7 was 2.3 and ranged from 0.8 to 6.0 m. DO levels at Station 7 ranged from 3.0 to 13.8 mg/L with a mean of 9.3 mg/L. Chlorophyll *a* concentrations at station 7 ranged between 0.79 µg/L and 27.65 µg/L with a mean of 6.69 µg/L. Ammonium concentrations ranged between 0.14 µM and 70.53 µM and averaged 6.97 µM. Phosphate ranged between 0.08 µM and 8.02 µM with a mean concentration of 2.58 µM. *Pseudo-nitzschia*, a genus of diatom that has been known to produce toxic algal blooms, was encountered in Buzzards Bay at Station 7. It is not known if the toxic species occurs in Buzzards Bay. Additionally, the dinoflagellate *Alexandrium tamarense*, which can produce paralytic shellfish poisoning toxins, was also found at Station 7 in abundances in the range of hundreds of cells per liter. After the New Bedford



WWTP was converted to a secondary treatment facility, water quality at station 7 clearly improved – increased water transparency, decreased ammonium, bacterioplankton and rod-shaped bacteria (Turner et al 2000).

WMA WATER WITHDRAWAL SUMMARY

There are no direct water withdrawals from this segment. (See upstream segments for information on cranberry bog withdrawals.)

NPDES SURFACE DISCHARGE SUMMARY

The City of New Bedford (MA0100781) is permitted (2 January 2001) to discharge 30 MGD of treated effluent via outfalls 001 and 002 to Buzzards Bay. The permit expires in 2006. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent and $C-NOEC \geq 12.5\%$ effluent. The facility was upgraded from a primary to a secondary treatment plant with a new outfall in August/September 1996.

Dartmouth, New Bedford and Fairhaven are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

As part of the New Bedford Harbor Superfund remediation process, a 30-year New Bedford Harbor Long Term Monitoring program (NBH-LTM) was developed to assess the spatial and temporal environmental changes as a result of remediation activities. The program involves collecting data related to the sediments of New Bedford Harbor and includes sediment chemistry analysis, sediment toxicity testing, characterization of the benthic invertebrate community, and bioaccumulation studies. Baseline sampling was conducted in 1993 with full scale sampling occurring before and after major remedial events or on a 3-5 year time frame (Nelson *et al.* 1996).

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in this segment from historic 1951 black and white aerial photography. Field surveys conducted by MA DEP in 2000 revealed stable eelgrass beds that appear to be expanding near Wilbur Point, Fairhaven and Round Hill Point, Dartmouth (Costello 2003).

Biology

As part of the New Bedford Harbor Long Term Monitoring Program, EPA conducted an evaluation of the benthic community condition. Species richness, EMAP index of benthic community condition, and community structure were examined using a probabilistic sampling design at nine hexagonal segments with approximately 30 stations per segment throughout the outer harbor area. In 1993, the first baseline sampling period, the outer harbor (this segment) can "generally be classified as healthy, based on high species richness, positive EMAP benthic index, and even distribution of the dominant species" (Nelson *et al.* 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Toxicity

Effluent

The City of New Bedford (MA0100781) conducted 25 whole effluent toxicity tests using the mysid shrimp (*M. bahia*) and the inland silverside (*M. berylinna*). The effluent was acutely toxic to *M. bahia* in six of the 23 valid test events with LC_{50} s ranging between 63.10 and $>100\%$ effluent. Acute toxicity was only detected once with *M. berylinna* (July 1997 $LC_{50} = 68.7\%$ effluent). $C-NOEC$'s for the silverside tests ranged from 12.5 to 100% effluent (no violations of the $C-NOEC$ permit limit).

Toxicity-Sediment

As part of the NBH-LTM program in 1993, sediment toxicity tests using the euryhaline benthic amphipod *Ampelisca abdita* were conducted on nine sediment samples from the outer harbor. Average percent survival from the outer harbor was 91% with only one sample showing acute toxicity (Nelson *et*

a/ 1996). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

Chemistry-sediment

In 1993, as part of the NBH-LTM Program, numerous sediment samples were collected from the top 2 cm of New Bedford outer harbor at 23 sites using a Young-modified van Veen grab sampler, composited, and analyzed for 18 PCB congeners, TOC, and AVS (acid volatile sulfide), and nine metals (Ni, Pb, Cd, Cu, Zn, Hg, As, Se, Cr). Additional monitoring was conducted in 1995 and 1999. EPA is drafting a report summarizing the data and it is expected to be available for review in 2003 (Nelson 2003).

From Nelson *et al* 1996. Average metal and total PCB concentrations (in $\mu\text{g/g}$ dry wt) in the outer harbor sediment from 1993. N (the number of stations in the segment) = 23 (includes samples from New Bedford Outer Harbor and Clarks Cove). S-EL (severe effect level) and L-EL (low effect level) from Persaud *et al* 1993 in $\mu\text{g/g}$ dry wt.

| Parameter | Average Concentration | S-EL | L-EL |
|------------|-----------------------|------|------|
| As | 3.1 | 33 | 6 |
| Cd | 0.28 | 10 | 0.6 |
| Cr | 19 | 110 | 26 |
| Cu | 19 | 110 | 16 |
| Hg | 0.07 | 2 | 0.2 |
| Ni | 5.3 | 75 | 16 |
| Pb | 18 | 250 | 31 |
| Se | 0.23 | NA | NA |
| Zn | 42 | 820 | 120 |
| Total PCBs | 0.83 | 530 | 0.07 |

Although eelgrass bed habitat data are available and it appears that the beds are stable and healthy, the habitat accounts for only about three percent of this segment's area. Therefore, given the limited current biological and physico-chemical (e.g., dissolved oxygen, nutrients, suspended solids) data, it is best professional judgment that the *Aquatic Life Use* is currently not assessed. Acute toxicity in the New Bedford WWTP discharge is of concern. However, its effect on water quality is likely very limited.

FISH CONSUMPTION

MDPH issued the following fish/seafood consumption advisory for New Bedford Harbor due to PCB contamination:

Area III (which encompasses this segment)—The general public should refrain from consuming all bottom fish, American eel, flounder, scup, and tautog from this area (#4948).

Based on the MPDH fish/seafood consumption advisory for New Bedford Outer Harbor, the *Fish Consumption Use* is assessed as impaired.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB11.0 and BB14.0 are approved, BB11.3 and BB14.3 are conditionally approved, and BB11.2, BB11.30, BB14.2, and BB14.30 are prohibited (DFWELE 2000).






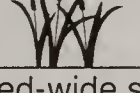
Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 4.82 mi^2 and impaired for 3.2 mi^2 .

PRIMARY AND SECONDARY CONTACT RECREATION

In this segment there are three public beaches - Noquitt Beach, Anthony Beach, and Town Beach. According to the Dartmouth Board of Health, there have been no closures (Dartmouth 2003 and MDPH 2002b).

Based on the more stringent shellfish harvesting guidelines, 4.82 mi² are assessed as support for the *Primary and Secondary Contact Recreational uses*. The remaining 3.2 mi² are not assessed.

Open Coastal Water Outside New Bedford Harbor (Segment MA95-62) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|--|--|-------------------------|---|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | IMPAIRED | PCBs | Contaminated sediments, CERCLA NPL (Superfund site) | |
| Shellfish Harvesting* |  | 4.82 mi ² SUPPORT 3.2 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | 4.82 mi ² SUPPORT 3.2 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 4.82 mi ² SUPPORT 3.2 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E

RECOMMENDATIONS OPEN COASTAL WATER OUTSIDE NEW BEDFORD HARBOR (SEGMENT MA95-62)

- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to remediate sources of pollutant causing the shellfish bed closures. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use*.
- Review the EPA New Bedford Harbor Long-Term Monitoring 1995 and 1999 sampling results when available to assess the *Aquatic Life Use*.
- Continue to review New Bedford WWTP whole effluent toxicity test reports as part of the *Aquatic Life Use* assessment. If acute toxicity continues to be problematic, determine the need for a Toxicity Identification Evaluation/Toxicity Reduction Evaluation (TIE/TRE).
- Implement the four salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town of Dartmouth. Sites in this subwatershed are located in Nonquitt and are labeled DA04, DA05, DA21 and DA22. The culvert of Nonquitt Marsh (site DA04) is the second highest priority site in Buzzards Bay. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

THE NASKETUCKET BAY DRAINAGE AREA

The Nasketucket Bay Drainage Area in Fairhaven and Mattapoisett includes the following two segments.

- Little Bay (Segment MA95-64)
- Nasketucket Bay (Segment MA95-65)

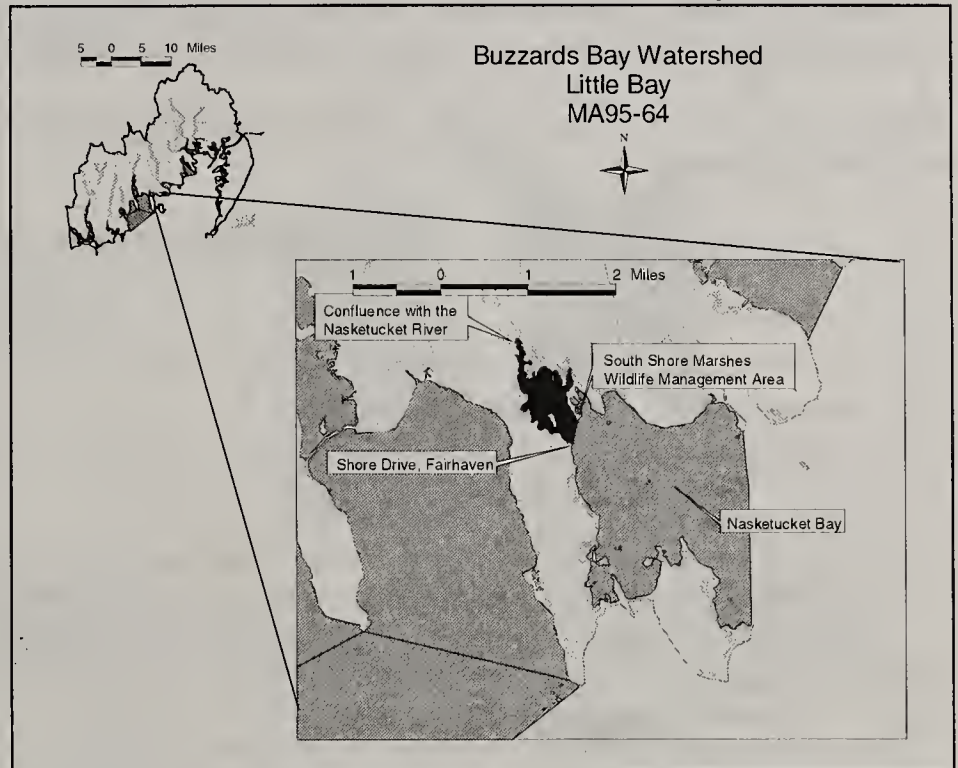
LITTLE BAY (SEGMENT MA95-64)

Location: From the confluence with the Nasketucket River to the mouth at Nasketucket Bay at a line drawn from the southern most point of land in the South Shore Marshes Wildlife Management Area (latitude: 41.625702; longitude: -70.854045) to a point of land near Shore Drive, Fairhaven (latitude: 41.621994; longitude: -70.855415).
Segment Area: 0.36 square miles
Classification: Class SA

Drainage area and land use estimates are not available for this segment.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in Little Bay between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More

intensive sampling of nutrients was conducted at the three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Two large dairy farms are located north of the embayment along Interstate 95. The Coalition noted that nitrogen and chlorophyll *a* concentrations are elevated and oxygen depletion is periodically below 60% saturation. The Coalition suggests that water quality degradation is due to inputs from residential dwellings and dairy farms (Howes *et al.* 1999). Little Bay received an average (1997-2001) Health Index Score of 46.8 (fair) (CBB undated b). It should be noted that the Coalition also monitors the Nasketucket River, which received an average (1997-2001) Health Index Score of 4.3 (poor), the worst score in the entire watershed (CBB undated b).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|------------------------------|---------|-------------------|-------------------------|---------------------|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Fairhaven Water Department** | 4094000 | 9P42409401 | 42409401 | 4094000-01G | Registered = 1.07 Permitted = 0.52 (1999 & 2000) Permitted = 0.62 (2001) | 1.37 | 1.42 | 1.42 |

* Excludes cranberry growers

**Fairhaven Water Department has six withdrawal points in the Buzzards Bay Watershed – one in Segment MA95-35, five in Segment MA95-36. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all six sources combined.

NPDES SURFACE WASTEWATER DISCHARGE SUMMARY

There are no regulated wastewater discharges in this subwatershed. It should be noted, however, that Fairhaven and Mattapoisett are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE


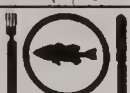



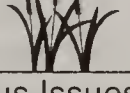
Although the *Aquatic Life Use* is not assessed for Little Bay, this use is identified with an Alert Status due to the Coalition for Buzzards Bay's health index score and the poor health index score for the Nasketucket River, the major freshwater input to the bay.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB22.0 and BB22.3 are conditionally approved and BB22.1 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

Little Bay (MA95-64) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|---------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED* | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert Status Issues identified—see details in use assessment section.

**For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS LITTLE BAY (MA95-64)

- Work with the Coalition for Buzzards Bay to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Develop a plan and conduct bacteria monitoring to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reopen shellfish beds. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use*.

NASKETUCKET BAY (SEGMENT MA95-65)

Location: From the confluence with Little Bay to the mouth at Buzzards Bay along a line drawn from the southern most point of Brant Island, Mattapoissett to the western tip of West Island, Fairhaven

Segment Area: 3.7 square miles

Classification: Class SA

Drainage area and land use estimates are not available for this segment.

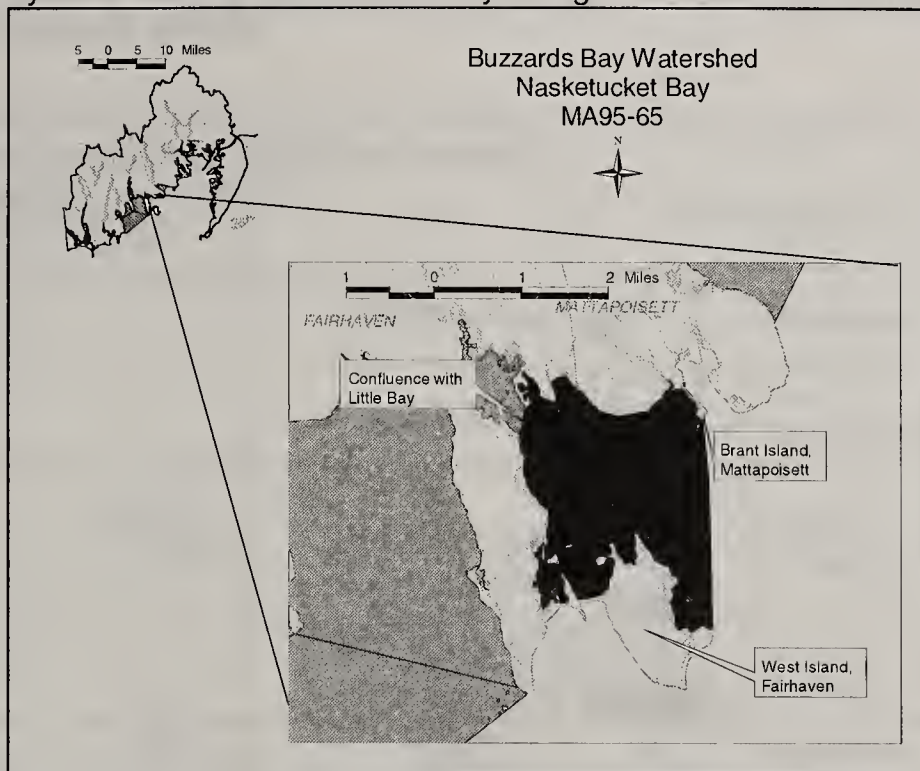
WMA WATER WITHDRAWAL SUMMARY

There are no regulated water withdrawals from this segment.

NPDES SURFACE WASTEWATER DISCHARGE SUMMARY

There are no regulated wastewater discharges in this subwatershed. It should be noted, however, that Fairhaven and Mattapoissett are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Nasketucket Bay between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at the station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The embayment supports recreational boating with 180 slips, primarily located at West Island (Howes *et al.* 1999). Nasketucket Bay received an average (1997-2001) Health Index Score of 61.1 (fair) (CBB undated b).



The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Nasketucket Bay between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at the station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The embayment supports recreational boating with 180 slips, primarily located at West Island (Howes *et al.* 1999). Nasketucket Bay received an average (1997-2001) Health Index Score of 61.1 (fair) (CBB undated b).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Nasketucket Bay from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Nasketucket Bay were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 2002 aerial photography revealed moderate to dense coverage of eelgrass along the northern shore between Shawn Cove and Brant Island and that the bed is fairly stable. Recent 2002 data is not available for the southern/western side of Nasketucket Bay. The beds identified in 1951 between Pea Island and White Rock, north of Round Island and Fish Island, and in North Cove appeared to have decline slightly between 1951 and 1994.

Due to the lack of recent (2002) data for the Fairhaven (western) portion of Nasketucket Bay, the *Aquatic Life Use* is currently not assessed.

SHELLFISH HARVESTING







The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB 18.0, BB18.1R, BB18.20, BB18.4R, BB21.0, BB21.20, and BB23.0 are approved and that areas B18.1, B22.0, BB22.3, and BB23.2 are conditionally approved (DFWELE 2000).

Based on the DMF shellfish growing area status, the *Shellfish Harvesting Use* is assessed as support for 3.2 mi² and impaired for 0.5 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

Based on the more stringent shellfish harvesting guidelines, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 3.2 mi². The remaining 0.5 mi² are currently not assessed.

Nasketucket Bay (MA95-65) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|---|-------------------------|-----------|---------|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | | |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 3.2 mi ² SUPPORT 0.5 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | Marina/boat pumpout discharges, marina/boat on vessel discharges |
| Primary Contact |  | 3.2 mi ² SUPPORT 0.5 mi ² NOT ASSESSED | | | | |
| Secondary Contact |  | 3.2 mi ² SUPPORT 0.5 mi ² NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

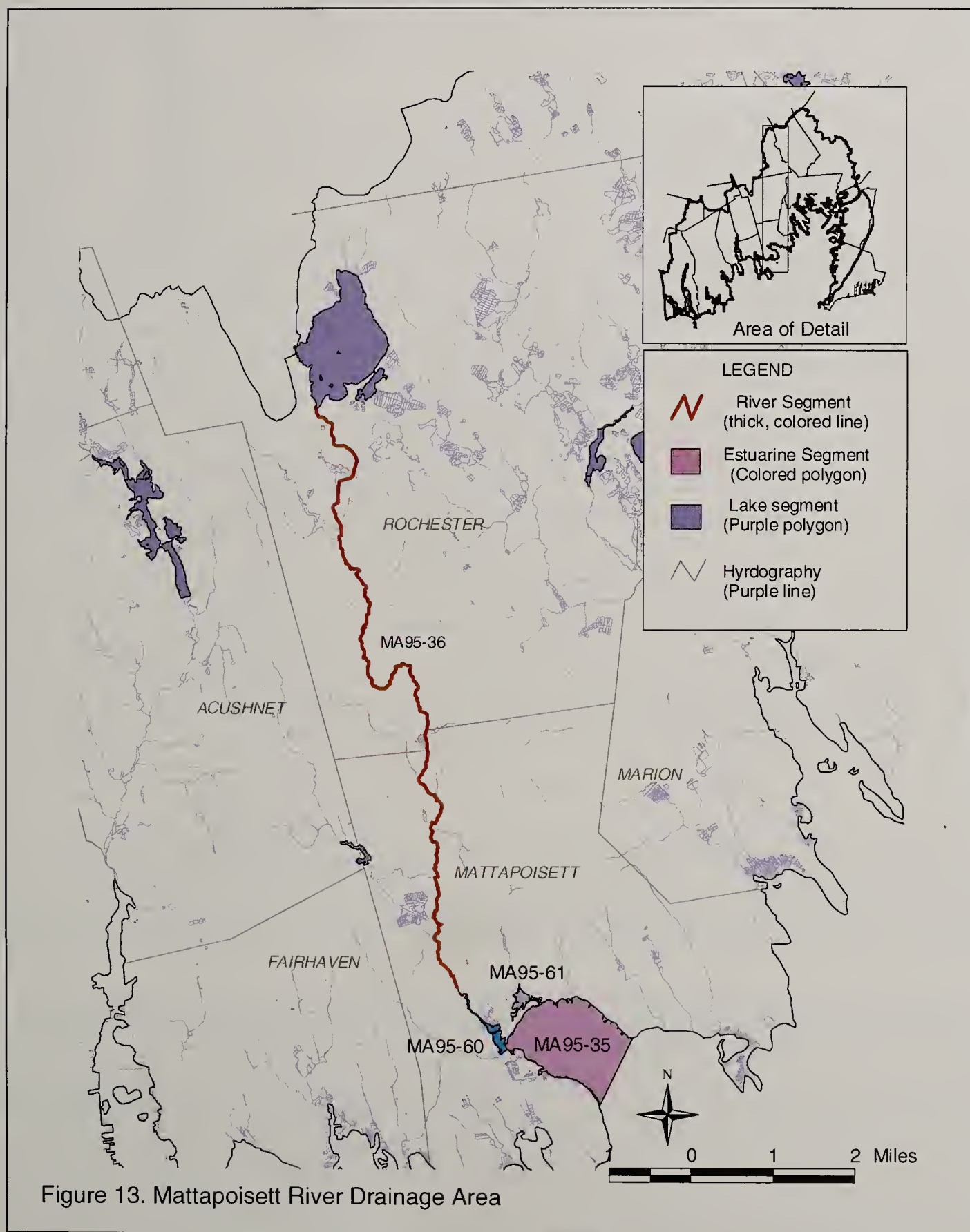
RECOMMENDATIONS NASKETUCKET BAY (MA95-65)

- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.
- Develop a plan and conduct bacteria monitoring to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports to reopen shellfish beds. Continue to review the DMF shellfish status report to assess the *Shellfish Harvesting Use*.

THE MATTAPOISETT RIVER DRAINAGE AREA

The Mattapoissett River Drainage Area in Mattapoissett and Rochester includes the following 4 segments.

- Mattapoissett River (Segment MA95-36)
- Mattapoissett River (Segment MA95-60)
- Eel Pond (Segment MA95-61)
- Mattapoissett Harbor (Segment MA95-35)



MATTAPOISETT RIVER (SEGMENT MA95-36)

Location: Outlet Snipatuit Pond, Rochester to River Road Bridge, Mattapoisett.

Segment Length: 10.01 miles

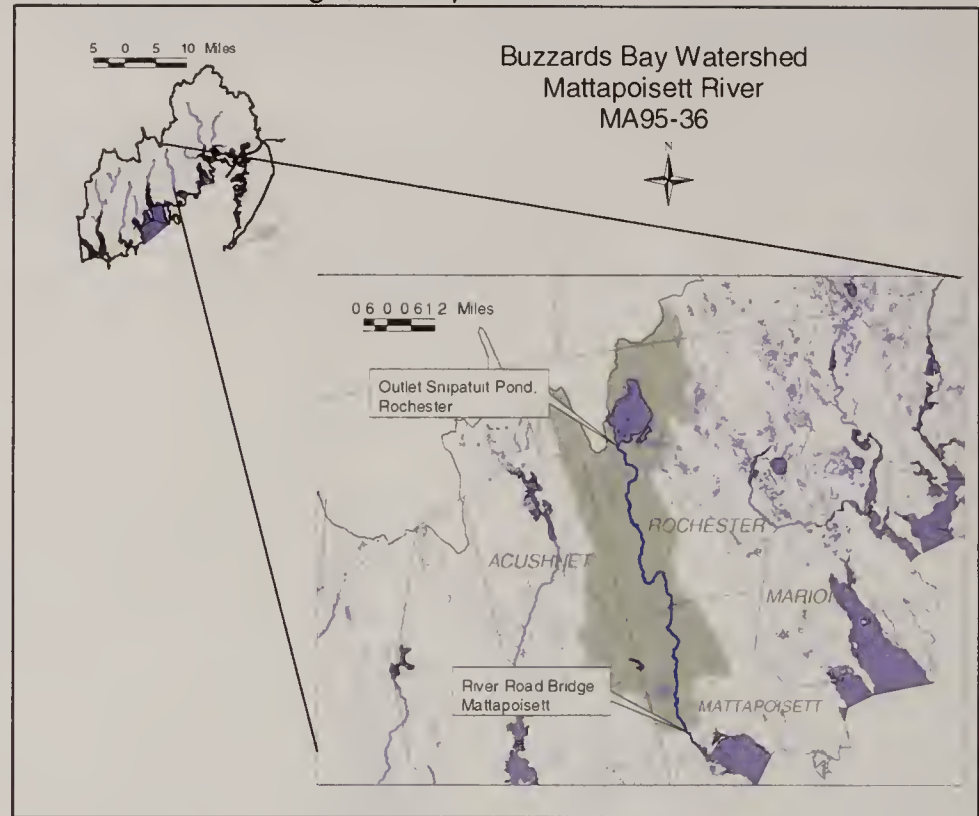
Classification: Class B

The drainage area of this segment is approximately 24.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 68% |
| Residential | 10% |
| Agriculture | 8% |

This segment is on the 1998 303(d) List Of Waters, needing confirmation, as not meeting the water quality standards for pathogens (MA DEP 1999).

In 2001 MassWildlife stocked trout in the Mattapoisett River for recreational fishing (DFWELE 24 September 2002).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------------------|---------|-------------------|-------------------------|---|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Fairhaven Water Department** | 4094000 | 9P42409401 | 42409401 | 4094000-03G 4094000-04G 4094000-05G 4094000-06G | Registered = 1.07 Permitted = 0.52 (1999 & 2000) Permitted = 0.62 (2001) | 1.37 | 1.42 | 1.42 |
| Marion Water Division*** | 4169000 | 9P42416901 | 42416910 | 4169000-05G 4169000-06G 4169000-07G | Registered = 0.56 Permitted = 0.15 (1999 & 2000) Permitted = 0.17 (2001) | 0.71 | 0.62 | 0.72 |
| Mattapoisett Water Department | 4173000 | 9P42417301 | 42417301 | 4173000-01G 4173000-02G 4173000-03G 4173000-04G 4173000-05G | Registered = 0.42 Permitted = 0.29 (1999 & 2000) Permitted = 0.34 (2001) | 0.56 | 0.51 | 0.52 |

* Excludes cranberry growers; ** Indicates system wide withdrawal, all sources not necessarily within this segment

**Fairhaven Water Department has six withdrawal points in the Buzzards Bay Watershed – one in Segment MA95-35, four in Segment MA95-36, and one (01G) in Segment MA95-64. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all six sources combined.

***Marion Water Division has seven withdrawal points in the Buzzards Bay Watershed – four in Segment MA95-06 and three in Segment MA95-36. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined. NOTE: Marion's sources in Segment MA95-06 are registered only.

The water suppliers (Marion, Fairhaven, and Mattapoisett) all work cooperatively to protect the resource through its Mattapoisett River Advisory Committee, established under Ch 92 of the Acts of 1997. It should be noted that Marion and Mattapoisett have implemented conservation measures in accordance with their WMA permit. The Town of Fairhaven is scheduled for its five-year WMA permit compliance review. The Town of Marion was found to be in compliance with its authorized withdrawals during its five-year permit compliance review in April of 2002 and the Town of Fairhaven has been found to be operating at well under their combined registered and permitted authorized withdrawals.

There are 524.370 acres of cranberry bog open space in the Mattapoissett River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 4.68 MGD.

NPDES SURFACE WASTEWATER DISCHARGE SUMMARY

There are no regulated wastewater discharges in this subwatershed. It should be noted, however, that Acushnet, Fairhaven, Mattapoissett and Rochester are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

According to the CBB the Mattapoissett River supports one of the more productive anadromous fish runs supporting both alewives and river herring (Howes *et al.* 1999). Fish passage is provided at the Route 6 bridge via a recently installed denil-type ladder.

A USGS study published in 1995 entitled *The Streamflow, Ground-Water Recharge and Discharge, and Characteristics of Surficial Deposits in Buzzards Bay Basin, Southeastern Massachusetts* indicated that major ground water withdrawals from shallow streamside public water supply wells may adversely impact streamflows in the Mattapoissett River (Bent 1995). A former fresh water mussel surveyor from the Natural Heritage and Endangered Species Program also documented low flow problems in the Mattapoissett River near the Route 6 bridge in September 1999 (DFWELE December 2002).

The wells along the Mattapoissett River in Rochester and downstream to the Wolf Island Rd wells draw from a sand and gravel deposit that underlies a semi-confining silt and clay layer. Over this semi-confining layer is a relatively thin surface layer of sand and gravel through which the narrow, shallow Mattapoissett River flows. The valley aquifer tracks back upstream to the Snipatuit Pond (Drake 2003).

DWM sampled (October 1996) the Mattapoissett River at the East End of Tinkham Lane (station NB13MAT) in Mattapoissett as part of the Biocriteria Development Project. The substrates in the sampled reach consisted of sand, silt, and clay mixed with detritus, and muck-mud. Flows were noted to be very slow and greater than 75% of the channel was full. Instream cover was lacking, although the water was sufficiently deep. Riffles or runs were virtually nonexistent. The banks were stable (less than five percent of the banks on both sides eroded) and well vegetated with native plants, trees, and shrubs. The riparian zone was greater than 18 meters with little human activities impacting the zone (MA DEP 1996b).

Biology

DWM conducted fish population sampling (8 October 1996) on the Mattapoissett River at the East End of Tinkham Lane (station NB13MAT) in Rochester as part of the Biocriteria Development Project. Four American eel (*Anguilla rostrata*), and one brown trout (*Salmo trutta*) were collected. A replicate reach was also sampled at this site and yielded four American eel and one redbfin pickerel (*Esox americanus americanus*) (MA DEP 1996b).

DFWELE Southeast District conducted fish population sampling on the Mattapoissett River downstream of Route 105 (and the DWM site) on 19 September 2000 using backpack electroshocking gear. Fifty-three American eel, eight tessellated darters (*Etheostoma olmstedii*), seven brown trout, three redbfin pickerel, two chain pickerel (*Esox niger*), one creek chubsucker (*Erimyzon oblongus*), one yellow perch (*Perca flavescens*), and one pumpkinseed (*Lepomis gibbosus*) were collected (Richards 2003).

Chemistry-water






DWM sampled the Mattapoissett River at the East End of Tinkham Lane (station NB13MAT) in Mattapoissett as part of the Biocriteria Development Project on 8 October 1996.

| Parameter | Result |
|-------------------------------|--------|
| Measurement Depth (m) | 0.1i |
| Time | 08:55 |
| Temperature (°C) | 9.6 |
| pH (SU) | 5.5 |
| Conductivity (µS/cm) | 64 |
| Total Dissolved Solids (mg/L) | 41.2 |
| Dissolved Oxygen (mg/L) | 9.5 |
| Percent Saturation (%) | 83 |
| Turbidity (NTU) | 6i |

i= inaccurate readings from Hydrolab likely

Too limited instream physicochemical/biological data are available so the *Aquatic Life Use* is currently not assessed for this segment of the Mattapoissett River. Potential effects of water withdrawals are of concern and, therefore, the *Aquatic Life Use* is identified with an Alert Status.

Mattapoissett River (MA95-36) Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|--|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified – see details in the use assessment section

RECOMMENDATIONS MATTAPOISETT RIVER (MA95-36)

- Review and implement recommendations in the DMF anadromous fish assessment report when available for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data for use in determining the status of the *Aquatic Life Use*.
- Design and conduct a survey to determine the hydraulic relationship between Snipatuit Pond, the aquifer and the Mattapoissett River. Determine whether seasonal declines in flow are the result of natural fluctuations in the pond or water withdrawals. Determine if cranberry bog operations manipulate flows in Snipatuit Pond. Data from the survey could be used in the assessment of the *Aquatic Life Use*.

MATTAPOISETT RIVER (SEGMENT MA95-60)

Description: From the River Road Bridge to the mouth at Mattapoisett Harbor, Mattapoisett

Segment Area: 0.05 square miles

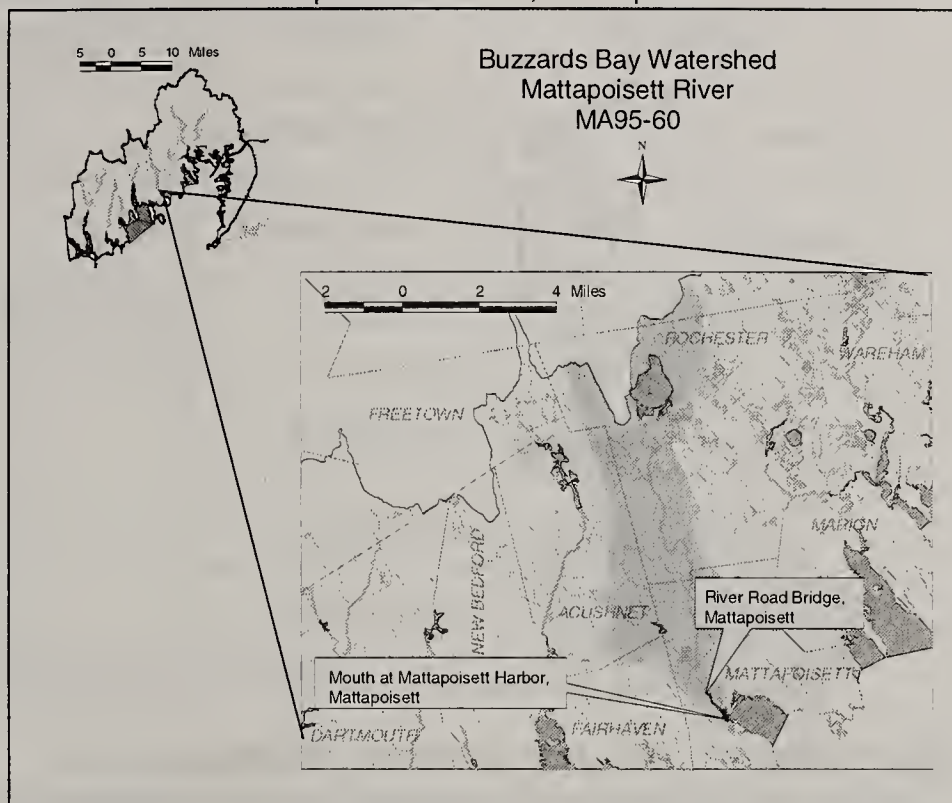
Classification: Class SA

The drainage area of this segment is approximately 24.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 67% |
| Residential | 10% |
| Agriculture | 8% |

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Mattapoisett Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of

nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. The Mattapoisett River supports one of the productive anadromous fisheries runs with up to "120,000 alewives and river herring returning to spawn per year". Nitrogen and chlorophyll *a* concentrations are elevated. The mouth of the Mattapoisett River shows frequent oxygen depletion (defined by CBB as <60% saturation). The Coalition suggests that water quality degradation may be related to the physiography of the system and only partially influenced by watershed land use (Howes *et al* 1999). The Mattapoisett River received an average (1997-2001) Health Index Score of 51.5 (fair) (CBB undated b).



WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY

There are no surface water discharges or authorized water withdrawals to this segment of the Mattapoisett River. It should be noted, however, that Fairhaven and Mattapoisett are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).






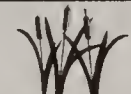
USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB26.1 is conditionally approved, and BB26.2 and 26.3 are restricted.

Based on the DMF Shellfish Status Report, this entire 0.05 mi² segment of the Mattapoisett River is assessed as impaired.

Mattapoissett River (MA95-60) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS MATTAPOISETT RIVER (MA95-60)

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, to improve water quality and increase habitat. If applicable, review data for use in determining the status of the *Aquatic Life Use*.
- Develop a plan and conduct a bacteria monitoring to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reopen shellfish beds. Continue to review the DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the six salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are MT07, MT08, MT18, MT19, MT31 and MT32. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

EEL POND (SEGMENT MA95-61)

Description: Coastal pond at the head of Mattapoisett Harbor, Mattapoisett

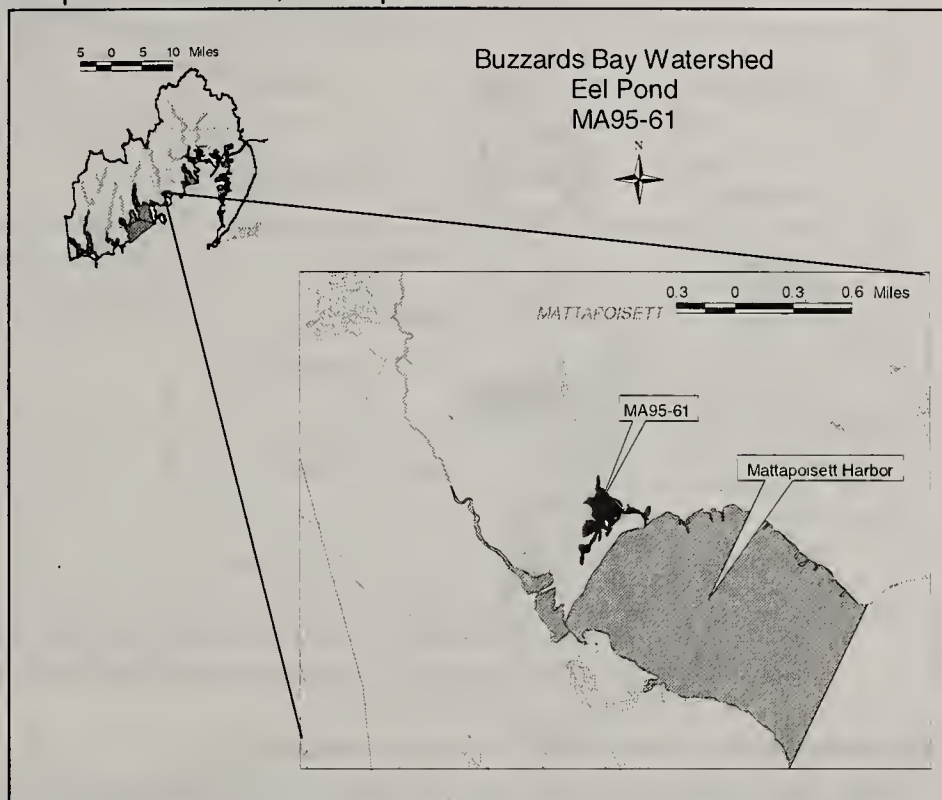
Segment Area: 0.04 square miles

CLASS: SB

Drainage area and land use estimates are not available for this segment.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in Eel Pond between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at the same two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*.

The Coalition noted that nitrogen and chlorophyll *a* concentrations are elevated, the pond is very turbid, with Secchi depths generally less than 80 cm, and, due to its shallow depth, water temperatures are elevated. Eel Pond shows frequent oxygen depletion (defined by CBB as <60% saturation). The Coalition suggests that water quality degradation is due to reduced tidal flushing, an adjacent golf course, lawn fertilizers, runoff, and storm water discharges (Howes *et al.* 1999). The culvert at the opening of Eel Pond (Site MT09) is considered a high priority site within the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* (BBP, 2002). The Eel Pond received an average (1997-2001) Health Index Score of 18 (poor) (CBB undated b).



WMA WATER WITHDRAWAL (APPENDIX F) AND NPDES SURFACE DISCHARGE SUMMARY

There are no authorized water withdrawals or regulated wastewater discharges to this segment of the Mattapoisett River. It should be noted, however, that Mattapoisett is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE







Too limited data are available so the *Aquatic Life Use* is not assessed for Eel Pond. The use is, however, identified with an Alert Status because of reduced tidal flushing, as well as the poor health index rating identified by the Coalition.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB27.0 is prohibited.

Based on the DMF shellfish growing area status this entire 0.04 mi² segment is assessed as impaired.

Eel Pond (MA95-61) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|---------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED* | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert Status issue identified-- see details in use assessment section

**For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS EEL POND (MA95-61)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Develop and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to improve water quality and possible reopen shellfishing beds. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use*.
- Further investigate the two tidal restrictions to Eel Pond, including reviewing the BBP funded flushing study and the report entitled *Eel Pond Water Quality Analysis and Nitrogen Loading Evaluation*. If warranted, implement necessary measures to improve flushing for the benefit of water quality and aquatic life.
- Work with the Coalition for Buzzards Bay to promote stewardship and implement environmentally friendly practices that will help reduce the leaching of fertilizers, which negatively affects the aquatic life, from the Reservation Country Club and residential properties into Eel Pond.
- Implement the four salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are MT09, MT20, MT21 and MT22. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

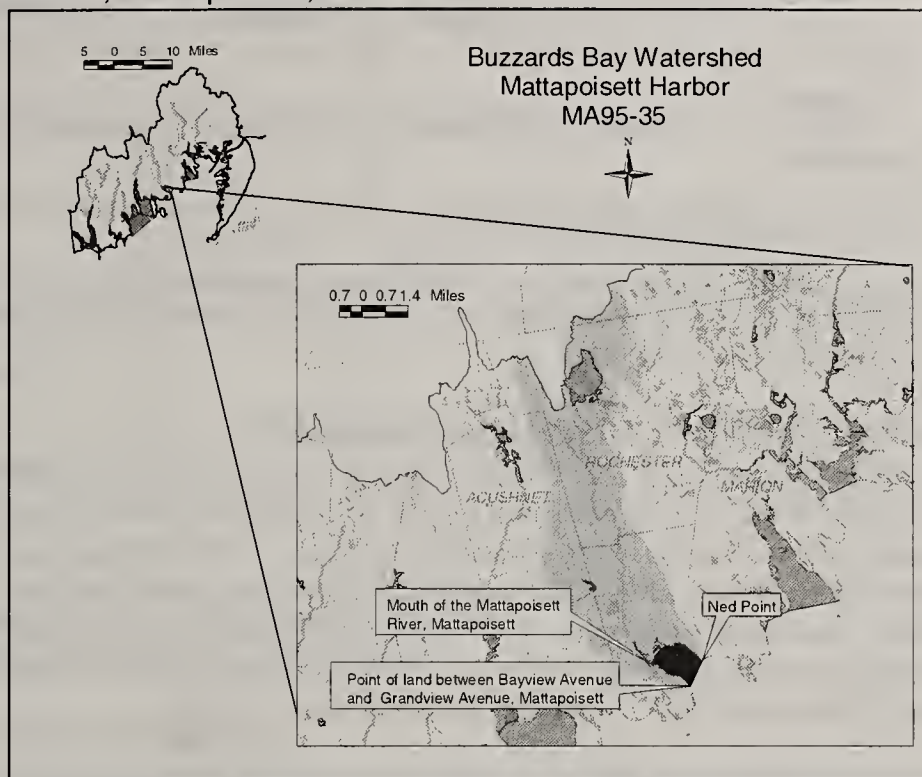
MATTAPOISETT HARBOR (SEGMENT MA95-35)

Location: From the mouth of the Mattapoisett River, Mattapoisett, to a line drawn from Ned Point to a point of land between Bayview Avenue and Grandview Avenue, Mattapoisett
Segment Area: 1.10 square miles
Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 28.4 square miles. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 65% |
| Residential | 12% |
| Agriculture | 7% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



There is public access to Mattapoisett Harbor at Short Wharf. This site, maintained by the Town of Mattapoisett, has one asphalt boat launch with twenty-two parking spaces. A fee is charged and/or a sticker is required (DFWELE 2002). There is a vessel sewage pumpout boat and facility at the Mattapoisett Town Dock on Main Street and a vessel sewage pumpout boat at Mattapoisett Boat Yard (BBP Undated and DMF 29 January 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in Mattapoisett Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at five stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Eelgrass beds are found along the periphery of the Harbor at depths <12 feet. Shellfish resources are abundant and include oyster, quahogs, and soft shell clams (Howes *et al.* 1999). Mattapoisett inner harbor received an average Health Index Score of 72.6 and Mattapoisett outer harbor received a score of 84.2 (both good/excellent) (CBB Undated b).

Dr. Jefferson Turner, students, and research associates at UMass Dartmouth have conducted 141 monthly cruises of Buzzards Bay between October 1987 and October 1998 to establish temporal and spatial trends of hydrography, water quality, and plankton community structure. Station 1 in Mattapoisett Harbor was sampled for conductivity, temperature, depth, Secchi disk depth, salinity, nutrients, chlorophyll *a* and phytoplankton. Salinity was "almost uniformly 30 ppt throughout the study at virtually all times". Mean surface temperatures at station 1 were below SWQS. Secchi disk depths at station 1 ranged from 1 to 7 m. Mean chlorophyll *a* concentrations at station 1 ranged between 0 µg/L and 14 µg/L. Mean ammonium concentrations ranged between 0 µM and 11 µM. Mean phosphate concentrations ranged between 0 µM and 3 µM (Turner *et al.* 2000).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|------------------------------|---------|-------------------|-------------------------|---------------------|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Fairhaven Water Department** | 4094000 | 9P42409401 | 42409401 | 4094000-02G | Registered = 1.07 Permitted = 0.52 (1999 & 2000) Permitted = 0.62 (2001) | 1.37 | 1.42 | 1.42 |

*Excludes any authorized cranberry growers.

**Fairhaven Water Department has six withdrawal points in the Buzzards Bay Basin – one in Segment MA95-35, four in Segment MA95-36, and one in Segment MA95-64. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all six sources combined.

NPDES SURFACE DISCHARGE SUMMARY

Old Rochester Regional School District (MA0102318) is permitted (30 October 1998) to discharge 0.0225 MGD effluent to Coen Brook, a tributary to Mattapoisett Harbor, from POTW outfall 001. The facility's whole effluent toxicity limit is $LC_{50} = 100\%$ effluent and C-NOEC = 64%. The permit includes secondary limits: BOD = 30 mg/L, TSS = 30 mg/L, fecal coliform bacteria = 200 cfu/100mL, TRC = 0.017 mg/L, and total ammonia = 2.7 mg/L. Old Rochester Regional School District tied in to the Mattapoisett sewer system in the summer of 2002 (Greenway 2003). Treated wastewater is ultimately discharged via the Fairhaven WWTF to New Bedford Inner Harbor.

It should also be noted that Mattapoisett is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

MA DEP identified the presence of eelgrass in Mattapoisett Harbor from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Mattapoisett Harbor were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 2002 aerial photography revealed moderate to dense coverage of eelgrass around the periphery of the bay. However, it appears that the beds may be declining slightly (no eelgrass found in the bed east of the outlet of Eel Pond in 2002). The condition of the eelgrass was identified as healthy with little to no drift algae and sparse epiphytes.

Based on the stable eelgrass bed habitat the *Aquatic Life Use* is assessed as support. This use is, however, identified with an Alert Status as the eelgrass bed habitat (especially east of Eel Pond) may be declining. Declining eelgrass bed habitat may be indicative of reduced water clarity or nutrient enrichment from anthropogenic activities (boating).

SHELLFISH HARVESTING







The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB25.0 is approved and BB25.11 and BB25.7 are prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for 1.0 mi² and impaired for 0.1 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

According to the Mattapoisett Board of Health, there have been no closures at any public beaches in town since the sampling program began (Mattapoisett BOH 2003). Based on the more stringent shellfish harvesting guidelines, the *Primary and Secondary Contact Recreational Uses* are assessed as support for 1.0 mi². The remaining 0.1 mi² are currently not assessed.

Mattapoisett Harbor (MA95-35) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|---|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | SUPPORT | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | 1.0 mi ² SUPPORT 0.1 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | 1.0 mi ² SUPPORT 0.1 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 1.0 mi ² SUPPORT 0.1 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert Status Issues identified—see details in use assessment section.

**For watershed-wide shellfish growing area data see Appendix E.

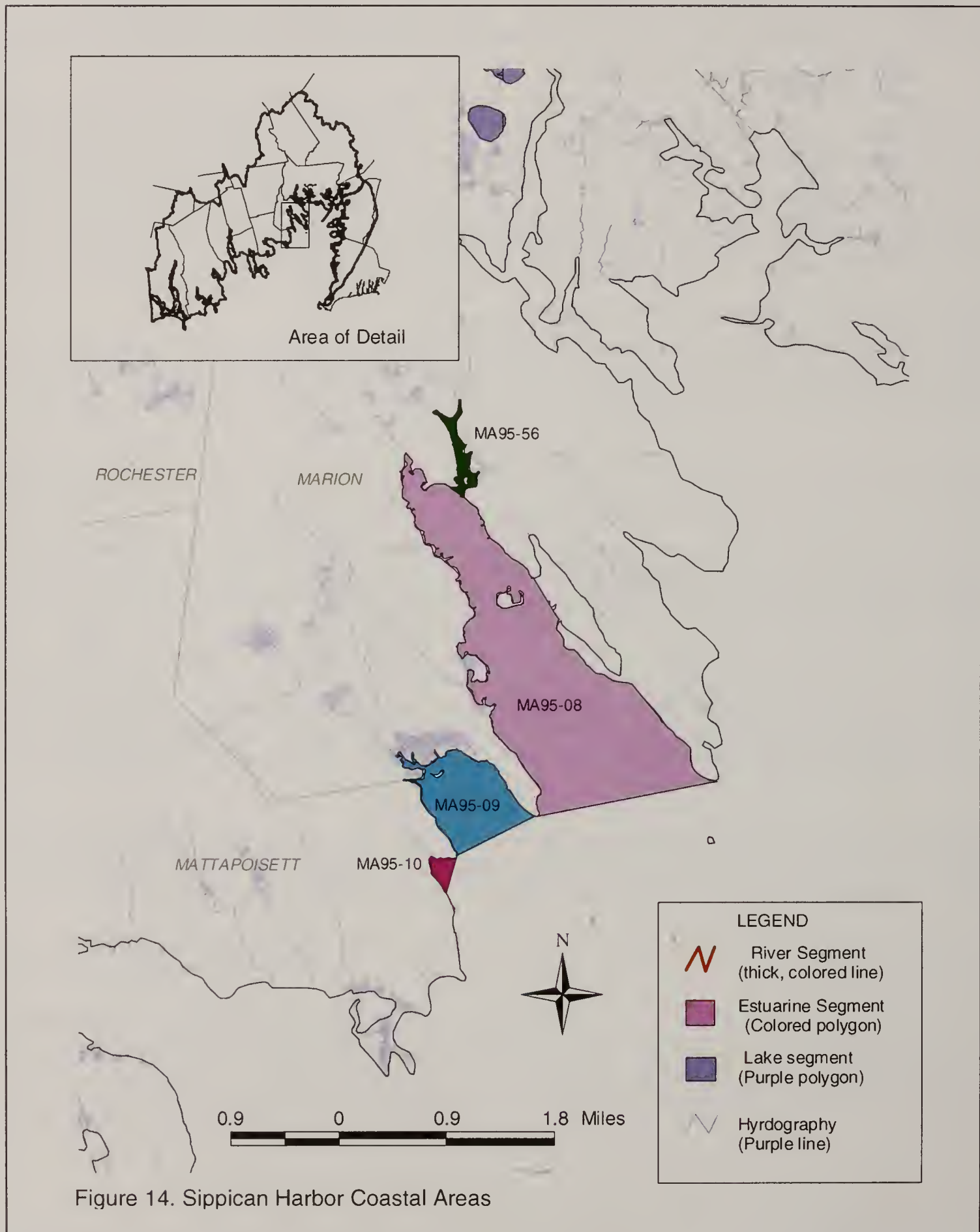
RECOMMENDATIONS MATTAPOISETT HARBOR (MA95-35)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Develop and implement a bacteria monitoring program to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to improve water quality and possibly reopen shellfish beds. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the ten (10) salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are MT01, MT02, MT03, MT04, MT05, MT06, MT33, MT35, MT36, and MT38. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.

THE SIPPICAN HARBOR COASTAL AREA

The Sippican Harbor Coastal Areas includes an inner cove and two adjacent open water estuaries in the following four segments.

- Hammett Cove (Segment MA95-56)
- Sippican Harbor (Segment MA95-08)
- Aucoot Cove (Segment MA95-09)
- Hiller Cove (Segment MA95-10)



HAMMETT COVE (SEGMENT MA95-56)

Location: Hammet Cove, Marion to the confluence with Sippican Harbor along a line from the southwestern most point of Little Neck to the end of the seawall on the opposite point.

Segment Area: 0.07 square miles

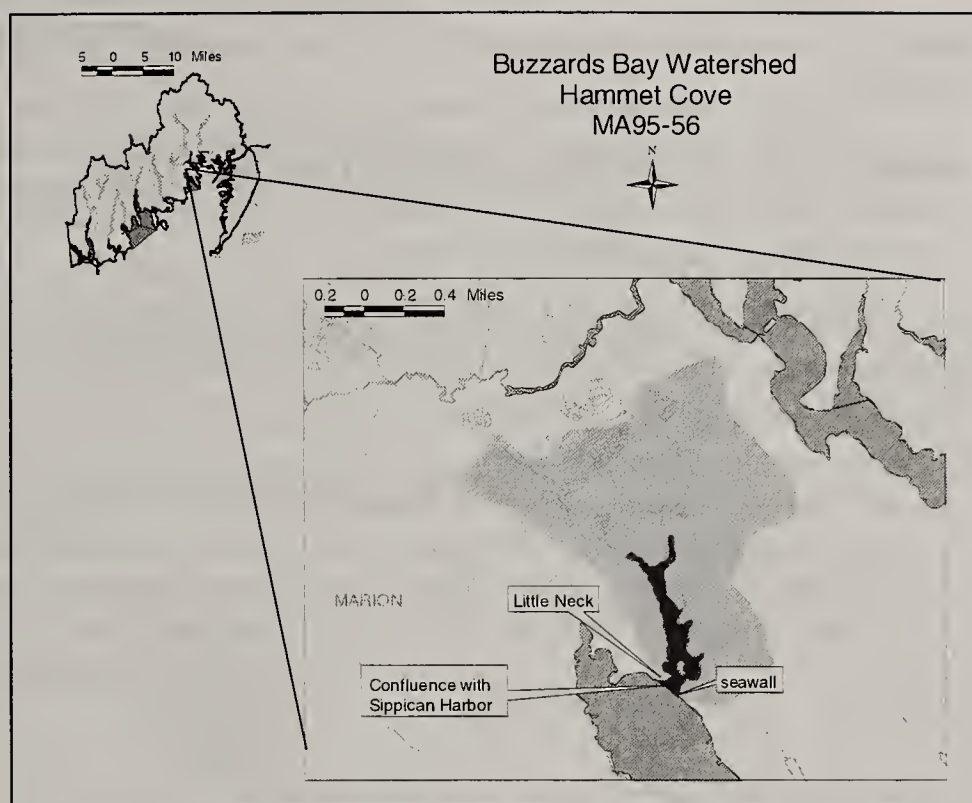
Classification: Class SA

The drainage area of this segment is approximately 1.35 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 47% |
| Residential | 25% |
| Open Land | 11% |

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Hammett Cove between May and September from 1992 to the present.

Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at all three stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Hammet Cove exhibits "poor nutrient related health"; with routine phytoplankton blooms and depleted oxygen levels below 60%. Chlorophyll *a*, particulate organic carbon, and total nitrogen are highest in the inner harbor/Hammetts Cove region and suggest a eutrophic and moderately degraded habitat. The five-year (1997-2001) Health Index Score for Hammett Cove is 32.1, which is poor (CBB Undated b).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 34.709 acres of cranberry bog open space in the Hammett Cove subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.31 MGD.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated discharges to Hammet Cove, however, it should also be noted that Marion is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

Eelgrass beds in Hammett Cove were mapped by MA DEP from aerial photography and field verified in 1994 and 2002 (Costello 2003). Eelgrass bed habitat extended from the mouth of the cove to the mouth of an unnamed tributary on the east side of the cove in 1994. Eelgrass bed habitat had declined and was limited to a small area north of an unnamed island.

Because of the decline in eelgrass bed habitat the Aquatic Life Use is assessed as impaired for Hammett Cove. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include septic systems and inputs from residential districts/lawns.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB32.0 and BB32.23 are approved and BB32.3 is prohibited (DFWELE 2000).



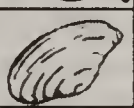



Based on the shellfish bed status 0.05 mi² are assessed as support and 0.02 mi² are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

There is one public beach in Hammett Cove. There have been no reported beach postings/closures during 2001 or 2002 (MDPH 2002b).

Based on the more stringent shellfish harvesting guidelines and because there have been no posting/closures, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.05 mi² of this segment. The remaining 0.02 mi² are currently not assessed.

Hammett Cove (MA95-56) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|---|---|----------------|---------|---|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (decline of eelgrass bed habitat) | Total nitrogen | | On-site treatment systems (septic systems), residential districts/lawns |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 0.05 mi ² SUPPORT 0.02 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | 0.05 mi ² SUPPORT 0.02 mi ² NOT ASSESSED | | | | |
| Secondary Contact |  | 0.05 mi ² SUPPORT 0.02 mi ² NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS HAMMETT COVE (MA95-56)

- Work with the Coalition for Buzzards Bay to implement their management recommendations for Hammet Cove including reducing fertilizer applications, treating storm water from Route 6, and encouraging the use of pumpout vessels/facilities.
- Develop a monitoring plan and conduct bacteria monitoring to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement as appropriate recommendations from DMF shellfish sanitary survey and triennial reports to improve water quality and abate pollution causing the closures of the shellfish beds. Continue to review shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the three salt marsh restoration projects identified in the 2002 *Atlas of Tidal Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are MN08, MN09 and MN10. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and effects on aquatic life.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.

SIPPICAN HARBOR (SEGMENT MA95-08)

Location: From the confluence with Hammets Cove to the mouth at Buzzards Bay (excluding Blankenship Cove and Planning Island Cove),
Marion

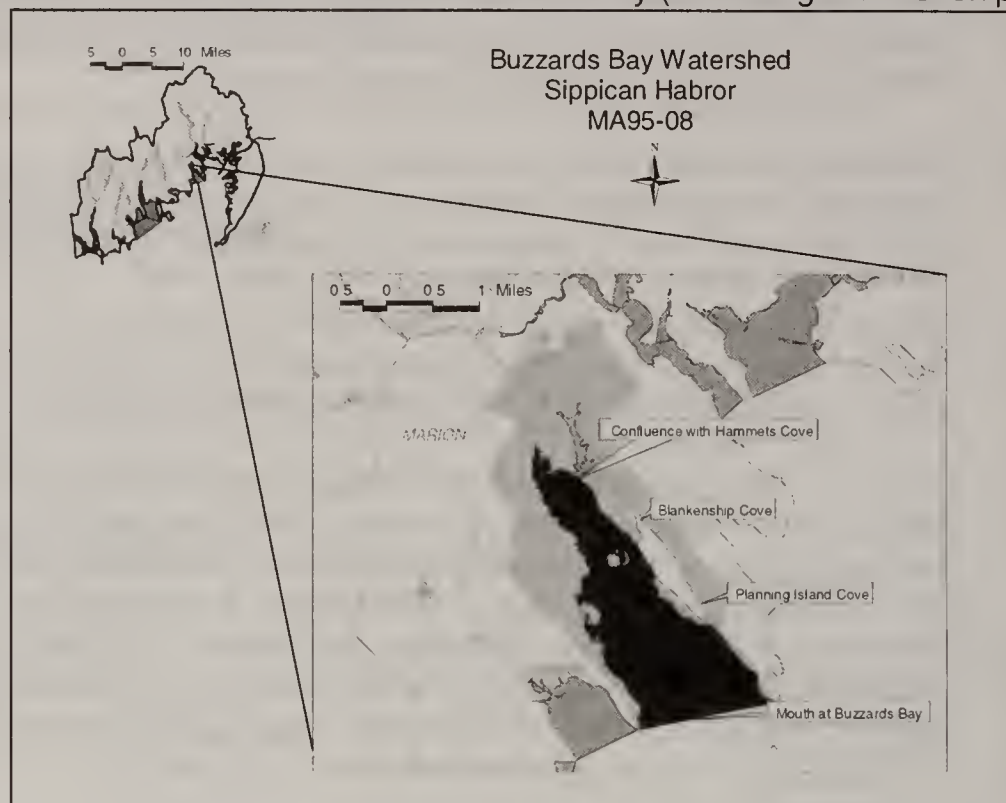
Segment Area: 2.0 square miles

Classification: Class SA, Shellfishing
(Open)

The drainage area of this segment is approximately 3.6 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 40% |
| Residential | 33% |
| Open Land | 12% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



There is a vessel sewage pumpout shoreside facility, pumpout boat, and porta-potty dump at Island Wharf located on Island Wharf Road, Marion (BBP Undated and DMF 29 January 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in Sippican Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at six stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. A roseate tern rookery on Bird Island supports approximately 1,000 nesting pairs in any given year. The flushing rate of inner Sippican Harbor is 8.6 days. Due to the depth of the Harbor, eelgrass beds are found only along the periphery. A "strong, increasing water quality gradient" exists from the inner to the outer harbor. Hammet Cove, not part of this segment, exhibits "poor nutrient related health" with routine phytoplankton blooms and depleted oxygen levels below 60%. Chlorophyll *a*, particulate organic carbon, and TN are highest in the inner harbor/Hammets Cove region and suggest a eutrophic moderately degraded habitat (Howes *et al* 1999). The five year (1997-2001) Health Index Score for Inner Sippican Harbor is 56.2 and for Outer Sippican Harbor is 72.0, which are fair and good/excellent, respectively (CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 37.820 acres of cranberry bog open space in the Sippican Harbor subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.34 MGD.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permits were issued by the EPA in October 2001 and will expire in October 2005:

Barden's Boat Yard Inc MAR05B624
Edey & Duff Ltd. MAR05B812

It should also be noted that Marion is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass beds in Sippican Harbor were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). MA DEP field verified 2002 aerial photography determined that the eelgrass beds identified in 1994 along the east and west sides of Ram Island had disappeared and that the remaining beds identified in 1994 around the periphery of Sippican Harbor remained stable/declined slightly.

Although eelgrass bed habitat data are available, the *Aquatic Life Use* is currently not assessed. This use is identified, however, with an Alert Status as the decline of eelgrass bed habitat may be indicative of reduced water clarity or nutrient enrichment from anthropogenic activities. Nitrogen thresholds and habitat quality guidelines are currently being developed by the Massachusetts Estuaries Project to better evaluate the status of the *Aquatic Life Use*.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB32.0 is approved, BB32.13 is conditionally approved, and BB32.1, BB32.4, BB32.5, BB32.9 and BB32.11 are prohibited (DFWELE 2000).







Based on the DMF shellfish status 1.7 mi² are assessed as support and 0.30 mi² are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

There are two public beaches in Sippican Harbor, Town Beach at Island Wharf and Silver Shell Beach. The beach at Island Wharf was closed to swimming on one occasion due to elevated *Enterococci* levels between July 12-13, 2001 (MDPH 2002b).

Based on the lack of beach posting/closures and the shellfish harvesting guidelines, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for this segment.

Sippican Harbor (MA95-08) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|--|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | 1.7 mi ² SUPPORT 0.30 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | SUPPORT | | | |
| Secondary Contact |  | SUPPORT | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert Status Issues Identified—see details in use assessment section.

**For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS SIPPICAN HARBOR (MA95-08)

- Work with the Coalition for Buzzards Bay to implement their management recommendations for Sippican Harbor including reducing fertilizer applications and treating storm water from Route 6, which will help to reduce nutrient and bacteria loading to Sippican Harbor.
- Continue to support the Town in its efforts to encourage the use of pumpout vessels/facilities to reduce bacteria inputs to this segment.
- Develop and implement a monitoring program for bacteria to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to mitigate pollution causing the closure of the shellfish beds. Continue to review the DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are MN30, MN31, MN05, MN06, and MN07. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

AUCOOT COVE (SEGMENT MA95-09)

Location: From the confluence with Aucoot Creek, Marion to the mouth at Buzzards Bay at a line drawn between Converse Point and Joes Point, Mattapoissett

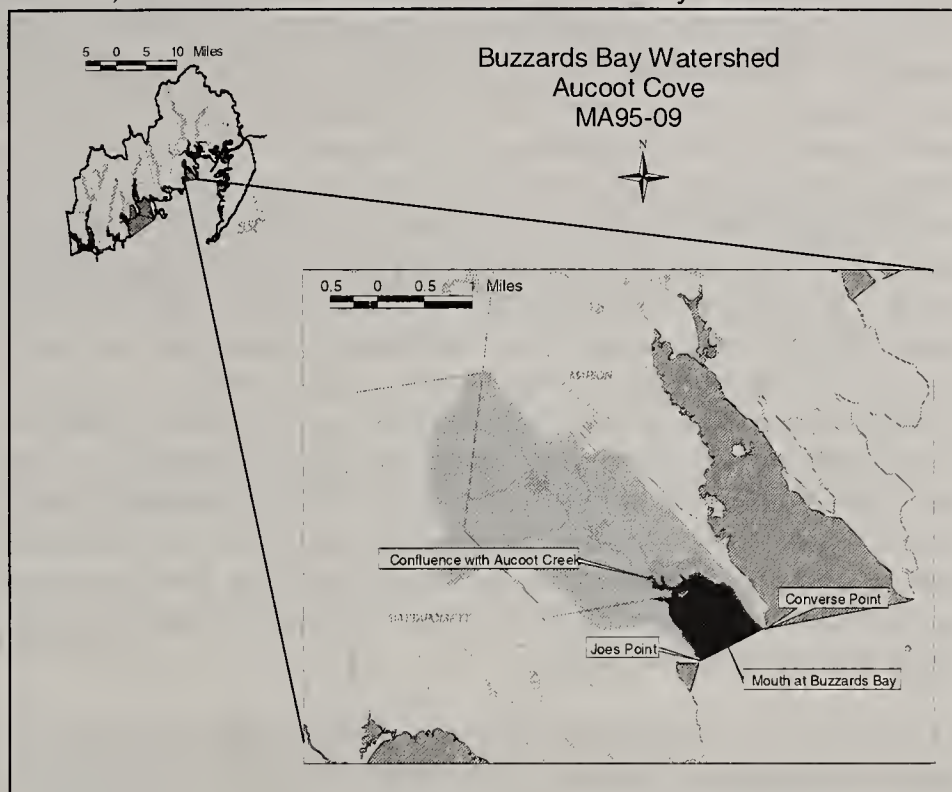
Segment Area: 0.50 square miles

Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 4.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 75% |
| Residential | 8% |
| Wetlands | 8% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



On 17 May 2000, at the request of EPA, DWM conducted benthic macroinvertebrate monitoring upstream and downstream from the Marion WWTP facility's discharge at three locations in an unnamed receiving stream known locally as "Effluent Brook". Monitoring was conducted using RBP I to discriminate obviously impacted and non-impacted areas from potentially affected areas. Upstream of the discharge a surprisingly diverse macroinvertebrate assemblage was observed. Fifteen taxa, four of which were pollution sensitive EPTs, were collected. Community composition and trophic structure changed abruptly at the Marion WWTP discharge point. Most trophic groups were displaced by more opportunistic gathering collectors, which are indicative of an aquatic community structured in response to organic enrichment and possibly low levels of dissolved oxygen. The return of additional trophic guilds and the addition of several macroinvertebrate taxa (including two EPT taxa) at the most downstream location suggest some recovery to the aquatic community. DWM recommended additional biomonitoring upstream and downstream of the discharge using more discriminating RBP methodology (Fiorentino 2000).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in Aucoot Cove between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at six stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al* 1999). Eelgrass beds are found only along the periphery of the Cove due to the depth (>12 feet). As a result of the Aucoot system circulation and bathymetry, Aucoot Cove "maintains a high level of water quality". The head of the cove, however, shows increased levels of nitrogen and chlorophyll *a*. The Macroalga (*Ulva lactuca*) was present in the region of the cove closest to the marsh and in the creek that receives the effluent from the Marion WWTP (Howes *et al* 1999). The average (1997-2001) Health Index Score for Inner Aucoot Cove was 53.9 (fair). Mid- and Outer Aucoot Cove received scores of 87.8 and 92.5 (good/excellent) respectively (CBB undated b). There is a gradient of nitrogen and chlorophyll *a* from the inner to the outer cove due mostly to the Marion WWTP. The waters at the head of Aucoot Cove showed "periodic depletions to levels less than 60% saturation, however, all sites were within or adjacent to wetlands" (Howes *et al* 1999).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 52.679 acres of cranberry bog open space in the Aucoot Cove subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.47 MGD.

NPDES SURFACE DISCHARGE SUMMARY

The Town of Marion Waste Water Treatment Plant is permitted (30 November 1998) to discharge 0.5 MGD of treated sanitary wastewater to an unnamed brook tributary to Aucoot Cove. The permit will expire in 2003. The facility's whole effluent toxicity limit is C-NOEC and $LC_{50} > 100\%$ effluent. The Town received a State Revolving Fund Loan to upgrade the existing plant for ammonia removal and will reduce the nitrogen load to Aucoot Cove and Buzzards Bay. Proposed upgrades include the construction of a new headworks with screening, grit removal, inlet tanks for flow equalization, Sequencing Batch Reactor tanks, and post equalization flow measurement. Effluent will then go to the existing disk filters and UV disinfection. The current UV disinfection process is problematic and it may also be replaced. The effluent line will be modified by the use of pipe bursting to relieve some of the low spots. (It should be noted that there is a local petition to relocate the discharge.) The new plant will also have some chemical addition for treatment and odor control and the existing ponds will be used for high flow management with the effluent pumped to the new inlet tanks. Marion is also going to construct a laboratory, administration building and a Supervisory Control And Data Acquisition (SCADA) system for instrumentation. Many of the existing pump stations are going to be upgraded and/or replaced. In addition, the Town is sewerage three areas of town where existing, dense housing cannot be adequately supported by on-site systems due to high groundwater and poor soils. Sewering these areas will reduce bacteria and nutrient loads to Sippican Harbor and the Weweantic River watershed. The goal is to meet the existing permit limits with some flexibility to meet lower nutrient limits. The plant construction began in August 2003 and the plant should begin startup in spring 2005.

It should also be noted that Marion is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Aucoot Cove from historic 1951 black and white aerial photography (Costello 2003). Field surveys conducted by MA DEP in 1994 and 2002 revealed moderate coverage of eelgrass. Additionally, the condition of the eelgrass was identified as healthy with little drift algae and sparse epiphytes (Costello 2003).

Toxicity

Effluent

Saltwater testing

The Town of Marion (MA0100030) conducted seven acute whole effluent toxicity tests between February 1996 and August 1997 using the test organisms *M. bahia* (mysid shrimp) and seven chronic tests using *M. beryllina* (inland silverside). No acute toxicity was detected (LC_{50} 's $> 100\%$ effluent). C-NOEC's were below the permit limit in only one test (75%).

Freshwater testing

Marion also conducted 13 chronic whole effluent toxicity tests between 17 January 2000 and 28 January 2003 using the test organisms *C. dubia* (water flea) and *P. promelas* (fat head minnow). The effluent was not acutely toxic ($LC_{50} > 100\%$ effluent) to the water flea or the fathead minnow, except in one test conducted on 23 January 2001 (*C. dubia* $LC_{50} = 30.5\%$ effluent; *P. promelas* $LC_{50} = 97.8\%$ effluent). Chronic toxicity was detected in seven of the 11 valid test events with C-NOEC's ranging between 12.5% and 50%. The remaining tests had C-NOEC's = 100%.

Ambient

Saltwater testing

Between February 1996 and August 1997 the Town of Marion collected dilution water from the unnamed tributary to Aucoot Cove for use as a diluent in their whole effluent toxicity testing. 48-hour survival of *M. bahia* was good (100%). 48-hour survival of *M. beryllina* was good (95-100%); chronic survival was good (87-98%).

Freshwater testing

Between 17 January 2000 and 28 January 2003 Marion also collected dilution water from the unnamed tributary to Aucoot Cove for use as a diluent in their whole effluent toxicity testing. Survival (48-hour and 7-day) of both *C. dubia* and *P. promelas* was good (90-100%). Toxicity in the unnamed tributary was documented on one occasion on 16 October 2000 with total mortality occurring.

Chemistry-water

Between 17 January 2000 and 28 January 2003, the Town of Marion collected water from the unnamed tributary to Aucoot Cove for use as dilution water in their whole effluent toxicity tests (n=7). Ambient chemical analysis included pH, TSS, hardness, alkalinity, conductivity, and ammonia.

pH

pH values ranged between 6.9 to 8.3 SU.

Total Suspended Solids

TSS concentrations ranged between <10 to 14 mg/L. Total solids concentrations ranged between 250 and 480 mg/L.

Conductivity

Conductivity ranged between 380 to 900 $\mu\text{mho/cm}$.

Hardness

Hardness values ranged between 40 and 102 mg/L as CaCO_3 (n=13).

Alkalinity

Alkalinity values reported in the Marion toxicity reports ranged between 16 and 110 (n=13).

Ammonia (as N)

Ammonia concentrations ranged between 0.9 and 11 mg/L. (No comparison to water quality criteria were conducted due to a lack of temperature data.)

Based on the stable eelgrass bed habitat the *Aquatic Life Use* is assessed as support. However, this use is identified with an Alert Status due to the chronic toxicity detected in the Town of Marion's whole effluent toxicity tests (discharge to an unnamed tributary to Aucoot Cove), elevated levels of nitrogen, and the presence of macroalgae reported by the Coalition for Buzzards Bay. It should be noted that planned upgrades to the WWTP would enhance ammonia removal and reduce nitrogen concentrations in the effluent.

SHELLFISH HARVESTING







The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB31.0 is approved and BB31.1 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status 0.46 mi^2 are assessed as support and 0.04 mi^2 are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

Based on the more stringent shellfish harvesting guidelines, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.46 mi^2 . The remaining 0.04 mi^2 are currently not assessed.

Aucoot Cove (MA95-09) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|---|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | SUPPORT | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | 0.46 mi ² SUPPORT 0.04 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | 0.46 mi ² SUPPORT 0.04 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 0.46 mi ² SUPPORT 0.04 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert Status issues identified—see details in use assessment section.

** For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS AUCCOOT COVE (MA95-09)

- Continue to monitor Marion's whole effluent toxicity testing data when evaluating the status of the *Aquatic Life Use*. If chronic toxicity continues to be problematic the need for a toxicity identification and reduction evaluation should be considered as part of their NPDES permit renewal.
- Conduct additional biomonitoring upstream and downstream of the Marion discharge using more discriminating RBP III methodology to assess the potential impacts from the discharge on the aquatic life.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, upgrades to the Marion WWTP, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports.
- Implement the one salt marsh restoration project identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that has been evaluated and prioritized by the Town (Site MN02). Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.

HILLER COVE (SEGMENT MA95-10)

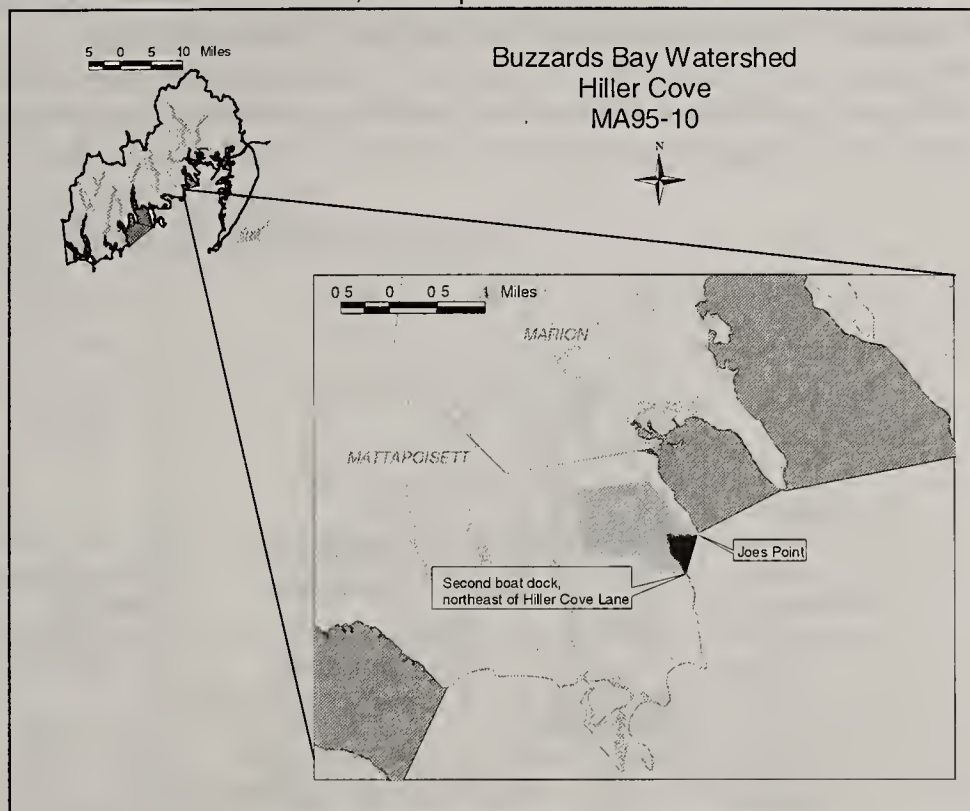
Location: The area landward of a line drawn between Joes Point, Mattapoissett and the second boat dock northeast of Hiller Cove Lane, Mattapoissett
Segment Area: 0.04 square miles
Classification: Class SA

The drainage area of this segment is approximately 0.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 75% |
| Residential | 17% |
| Open land | 5% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Hiller Cove between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al.* 1999). Eelgrass beds are found along the periphery of the cove due to the depth (>12 feet). As a result of the open well-flushed nature of the cove, Hiller Cove "maintains a high level of water quality" (Howes *et al.* 1999). The average (1997-2001) Health Index Score for Hiller Cove is 85.4 (good/excellent) (CBB Undated b).



WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY

There are no regulated water withdrawals or wastewater discharges in this segment. It should be noted, however, that Mattapoissett is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Hiller Cove from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Hiller Cove were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 1999 aerial photography determined that the eelgrass bed identified in 1994 had declined.

Too limited data are available and, therefore, the *Aquatic Life Use* is not assessed for Hiller Cove. This use is, however, identified with an Alert Status due to the decline in eelgrass bed habitat, which may be indicative of declines in water quality (e.g., elevated nutrients, reduced clarity).

SHELLFISH HARVESTING



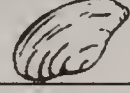



The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB30.0 is classified as approved and BB30.1 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status 0.03 mi² are assessed as support and 0.01 mi² are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

There are no closures or postings at the public Harbor Beach according to the MDPH database. Based on the more stringent shellfish harvesting guidelines, the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.03 mi². The remaining 0.01 mi² are currently not assessed.

Hiller Cove (MA95-10) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|---|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | 0.03 mi ² SUPPORT 0.01 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | 0.03 mi ² SUPPORT 0.01 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 0.03 mi ² SUPPORT 0.01 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*Alert Status issues identified—see details in use assessment section

** For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS HILLER COVE (MA95-10)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs.
- Review and implement, as appropriate, recommendations from DMF shellfish survey program reports.
- Implement the three salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are MT15, MT16 and MT17. The latter, Site MT17, is a town owned rock wall that has sunk and is clearly overwashed. It is considered the fifth highest priority in Buzzards Bay.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality.

THE WEWEANTIC RIVER DRAINAGE AREA

The Weweantic River Drainage Area principally in Wareham and Marion has its headwaters located in Rochester, Middleborough, Carver, and Plymouth. It consists of the following five segments.

- Weweantic River (Segment MA95-04)
- Sippican River (Segment MA95-06)
- Sippican River (Segment MA95-07)
- Beaverdam Creek (Segment MA95-53)
- Weweantic River (Segment MA95-05)

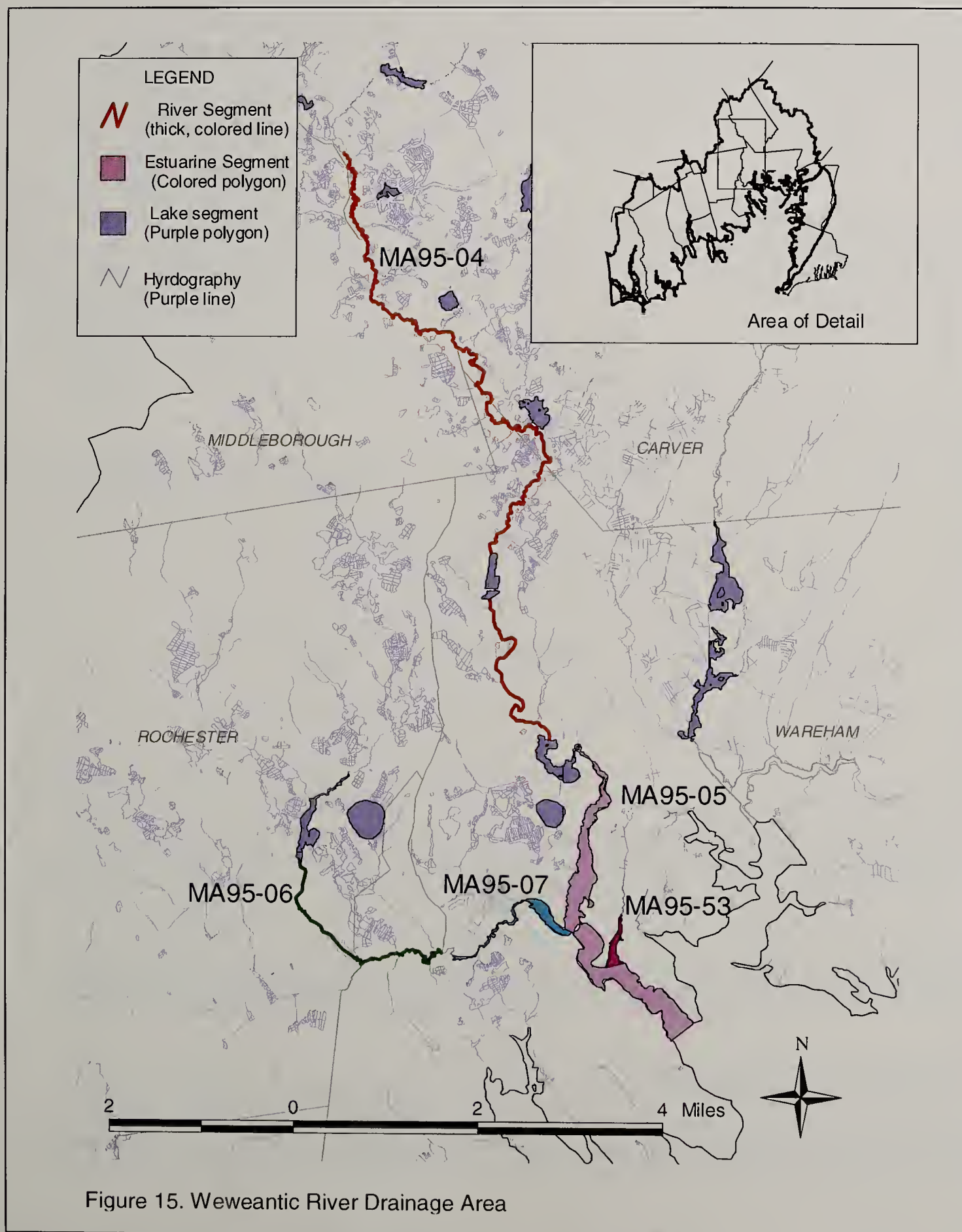


Figure 15. Weweantic River Drainage Area

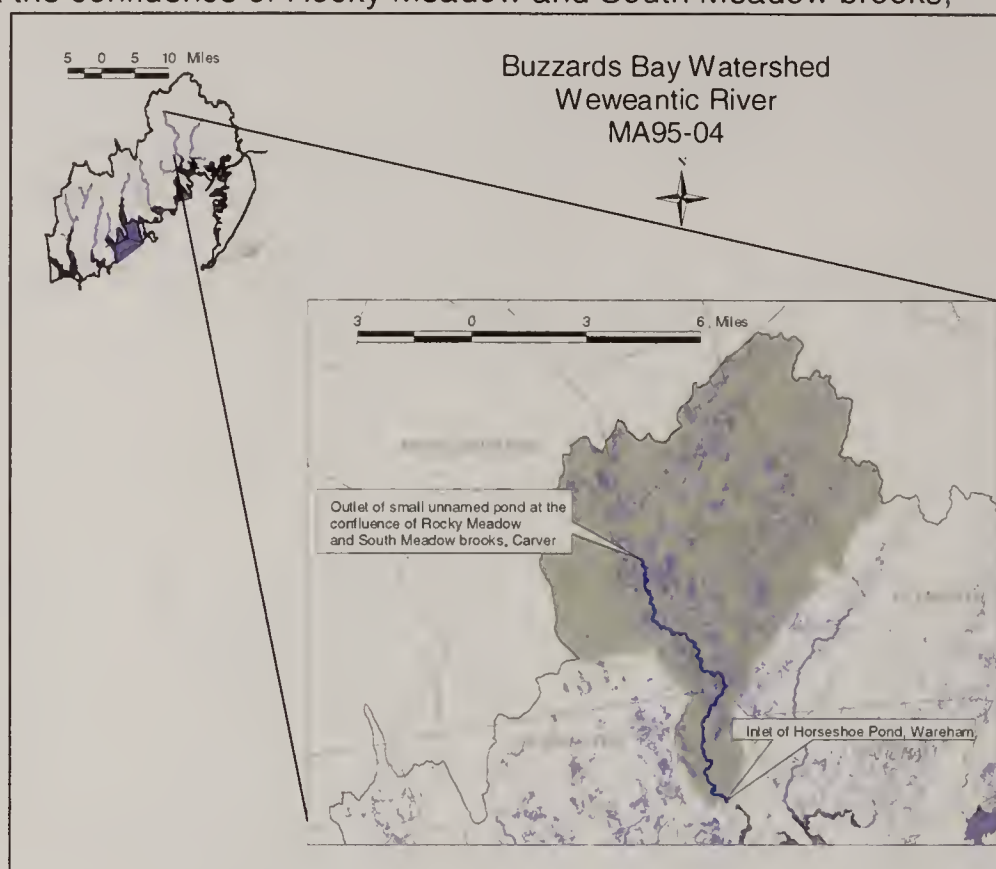
WEWEANTIC RIVER (SEGMENT MA95-04)

Location: Outlet of small, unnamed pond at the confluence of Rocky Meadow and South Meadow brooks, Carver to the inlet of Horseshoe Pond, Wareham
 Segment Length: 11.5 miles
 Classification: Class B, Warm Water Fishery

The drainage area of this segment is approximately 56.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 52% |
| Open Land | 22% |
| Residential | 14% |

This segment of the Weweantic River is on the Massachusetts 1998 303(d) List of Waters, needing confirmation, as not meeting water quality standards for pathogens (MA DEP 1999).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|---|---------|-------------------|-------------------------|---|-----------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Lakeville Redi-Mix/ Lakeside Crushing, South Carver | | | 42405216 | Tremont St. Well Tremont St. Reservoir | Registered = 0.28 | 0.08 | 0.08 | 0.04 |
| Plymouth DPW- Water Division, Plymouth | 4239000 | 9P42423901 | | 4239000-04G 4239000-08G | Permitted = 1.59** | 1.28 | 1.34 | 1.49 |
| South Meadow Village, Carver | 4052001 | 9P42405202 | | 4052001-01G | Permitted = 0.19 | NR | 0.15 | 0.09 |

*Excludes any authorized cranberry growers.

**This is the maximum daily volume that the Plymouth DPW-Water Division can withdraw from its Buzzard Bay sources. The average withdrawal volumes indicated are for the Buzzards Bay sources only. The Plymouth DPW-Water Division is permitted to withdraw 5.76 MGD in year 1999 and 6.06 MGD in years 2000 & 2001 from its South Coastal and Buzzards Bay sources combined.

NR – No report in file.

There are 6611.882 acres of cranberry bog open space in the Weweantic River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 59.04 MGD.

NPDES SURFACE DISCHARGE SUMMARY

Carver and Wareham are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

FERC

The Town of Wareham owns a 300-Kilowatt FERC-exempt hydroelectric power facility at the Tremont Dam on this segment of the Weweantic River. The FERC license (FERC exempt # P-3894) was issued May 1981. There is no expiration date for an exempt license (Goggins 2001). The earth/stone masonry dam, built in 1845, is 1200 feet long, 15 feet high, and has a storage capacity of 200 acre feet (8,712,000 ft³ or 246,696 m³). There are two 12' high X 10' wide sluice gates in the dam. This facility has two underground concrete penstocks (7' X 10' x 18'), which convey water to two turbines that power a 75-KW capacity generator and a 125-KW generator (Cataldo 2003). The Tremont Dam facility has not operated since 1999 and both turbines are mothballed. This facility is required to release a minimum flow of 10 cfs. There are no fish passage requirements. It was noted in the last environmental inspection report that there was a large sinkhole on the left side of the dam along the overflow spillway. The Town maintains a public park downstream of the left embankment of the dam. There is no public access to the Weweantic River for boats or the general public downstream of the dam. Additionally, there is no formal access for boats or the public on Tremont Mill Pond, upstream of the dam (FERC 26 July 2001).

USE ASSESSMENT

AQUATIC LIFE






Although no instream water quality data are available to assess the status of the *Aquatic Life Use*, it is identified with an Alert Status because of the numerous cranberry bog operations in the subwatershed, which may affect instream flows and the lack of anadromous fish passage at the dams.

AESTHETICS

The Weweantic River Stream Team conducted a shoreline survey in May 2001. They did not report any objectionable trash, debris, oil sheens, etc. in this segment of the Weweantic River (WRST 2002).

The *Aesthetic Use* is assessed as support based on the high aesthetic quality (i.e., no objectionable conditions).

Weweantic River (MA95-04) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|---|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | SUPPORT |

* Alert Status Issues identified—See details in use assessment section

RECOMMENDATIONS WEWEANTIC RIVER (MA95-04)

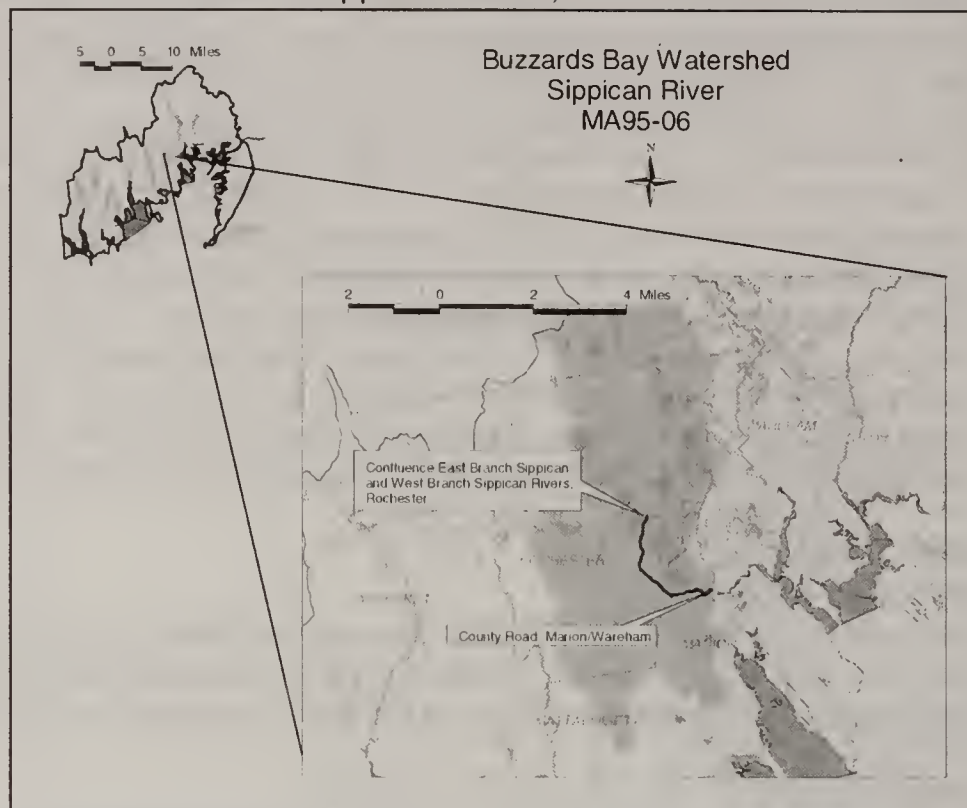
- Work with the Weweantic River Stream Team to implement their recommendations from their shoreline survey. Encourage the stream team to continue conducting surveys to assess the *Aesthetics Use*.
- Design and implement a bacteria monitoring program to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and/or the Phase II community storm water management programs and to assess the recreational uses.
- DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juveniles. DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data to assess the *Aquatic Life Use*.
- Inspect the sinkhole (identified during the last FERC inspection) on the left side of the dam spillway to determine if it is a source of sedimentation to the river and take actions to remediate if necessary.

SIPPICAN RIVER (SEGMENT MA95-06)

Location: Confluence East Branch Sippican and West Branch Sippican Rivers,
Rochester to County Road,
Marion/Wareham
Segment Length: 3.6 miles
Classification: Class B, Warm Water
Fishery

The drainage area of this segment is approximately 28.1 square miles.
Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 65% |
| Open Land | 16% |
| Residential | 8% |



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------------|---------|-------------------|-------------------------|--|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Marion Water Division** | 4169000 | 9P42416901 | 42416910 | 4169000-01G 4169000-02G 4169000-03G 4169000-04G | Registered = 0.56 Permitted = 0.15 (1999 & 2000) Permitted = 0.17 (2001) | 0.71 | 0.62 | 0.72 |

*Excludes any authorized cranberry growers.

**Marion Water Division has seven withdrawal points in the Buzzards Bay Basin – four in Segment MA95-06 and three in Segment MA95-36. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined.
NOTE: Marion's sources in Segment MA95-06 are registered only.

There are 1990.543 acres of cranberry bog open space in the Sippican River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 17.77 MGD.

NPDES SURFACE DISCHARGE SUMMARY

The following general storm water permit was issued by the EPA in October 2001 and will expire in October 2005:






Inshore Boat Shop Inc. MAR05B998

It should also be noted that Marion, Rochester and Wareham are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their systems over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

Although no instream water quality data are available to assess the status of the designated uses of this segment of the Sippican River, the *Aquatic Life Use* is identified with an Alert Status because of the numerous cranberry bog operations in the subwatershed, which may affect instream flows and the lack of anadromous fish passage at the dams.

Sippican River (MA95-06) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|---|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified – see details in the use assessment section

RECOMMENDATIONS SIPPICAN RIVER (MA95-06)

- DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juveniles. DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of the aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and to increase habitat. If applicable, review data to assess the *Aquatic Life Use*.

SIPPICAN RIVER (SEGMENT MA95-07)

Location: County Road to confluence with Weweantic River, Marion/Wareham

Segment Area: 0.08 square miles

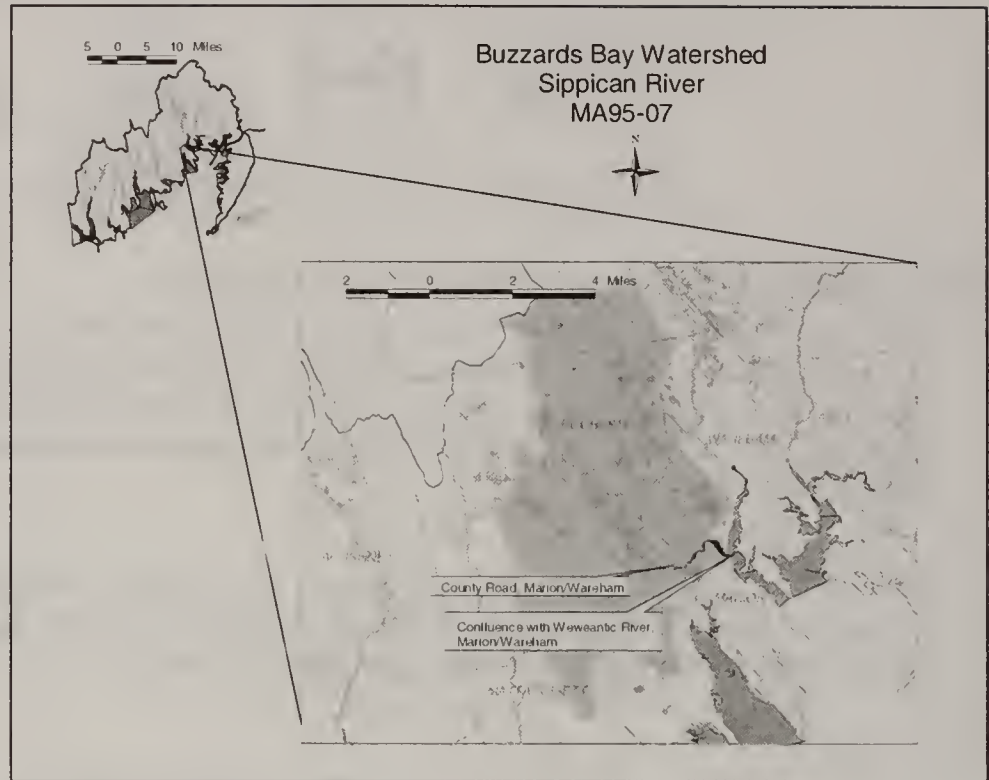
Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 31.6 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 63% |
| Open Land | 16% |
| Residential | 9% |

This segment of the Sippican River is on the 1998 303(d) List of Waters, needing confirmation, as not meeting water quality standards for pathogens (MA DEP 1999).

The Sippican Land Trust received a \$4,650 Riverways Small Grant to support the Sippican River Access Project. The grant money will be used to help purchase land along the Sippican River to protect the river and its corridor by establishing public access to the river in the Town of Marion for passive recreation and monitoring of herring runs (Riverways 2002).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

There are 2313.124 acres of cranberry bog open space in the Sippican River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 20.65 MGD. This estimate includes the estimate of water use for the upstream segment MA95-06. An estimate of water use for the bog area contained exclusively in segment MA95-07 is 2.88 MGD.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated discharges to this subwatershed. It should be noted, however, that Marion and Wareham are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their systems over the five-year permit term (Scarlet 2003).







USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that area BB35.4 is classified as prohibited (DFWELE 2000).

Based on the DMF shellfish status this entire segment (0.08 mi²) is assessed as impaired.

Sippican River (MA95-07) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|-------------------------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | 0.08 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS SIPPICAN RIVER (MA95-07)

- Design and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to mitigate pollution causing shellfish bed closures. Continue to review the DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the salt marsh restoration project identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that has been evaluated and prioritized by the Town (Site WH02). Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data to assess the *Aquatic Life Use*.

BEAVERDAM CREEK (SEGMENT MA95-53)

Location: Outlet from cranberry bogs southeast of Route 6, Wareham to confluence with Weweantic River, Wareham

Segment Area: 0.04 square miles

Classification: Class SA

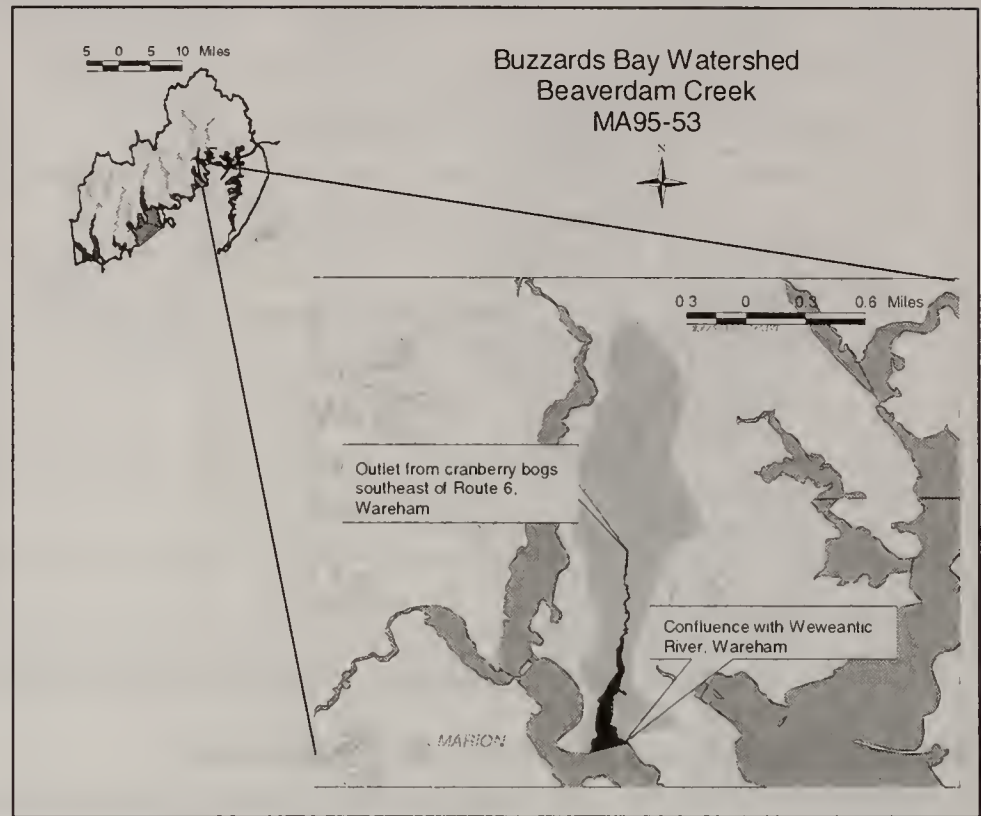
The drainage area of this segment is approximately 0.7 miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Residential | 40% |
| Forest | 39% |
| Open Land | 9% |

WMA WATER WITHDRAWAL SUMMARY AND NPDES SURFACE DISCHARGE SUMMARY

There are 40.75 acres of cranberry bog open space in the Beaverdam Creek subwatershed (UMass Amherst 1999).

For the purpose of this report a conservative estimate of water use for this bog area is 0.36 MGD. It should be noted, however, that Wareham is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).



USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

Eelgrass beds in Beaverdam Creek mapped by MA DEP from field verified 1994 aerial photography extended from the mouth of the creek to just south of an imaginary line extended from Fillmore Street/Washington Street. MA DEP field verified 2002 aerial photography determined that the eelgrass bed identified in 1994 had declined and that moderate to dense algae was present in areas where eelgrass beds had been found previously.







Because of the decline of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include operations related to cranberry bogs and septic systems.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that areas BB35.1 is prohibited (DFWELE 2000).

Based on the status of the DMF shellfish growing areas in Beaverdam Creek 0.04 mi² are assessed as impaired.

Beaverdam Creek (MA95-53) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|---|----------------|---|
| | | | Known | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (Decline of eelgrass bed habitat) | Total nitrogen | On-site treatment systems (septic systems), specialty crop production related to cranberry bogs |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS BEAVERDAM CREEK (MA95-53)

- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to remediate sources of bacteria and reopen shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.

WEWEANTIC RIVER (SEGMENT MA95-05)

Location: Outlet Horseshoe Pond, Wareham to mouth at Buzzards Bay, Marion/Wareham

Segment Area: 0.62 square miles

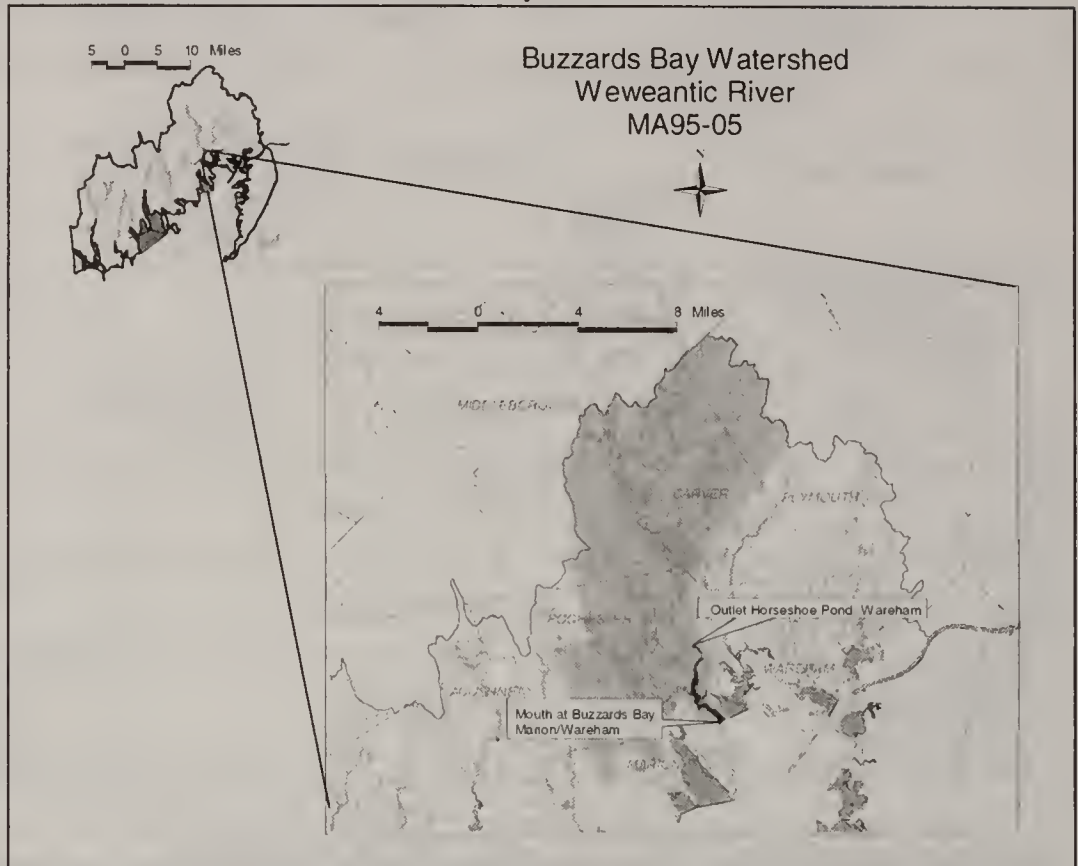
Classification: Class SA,
Shellfishing (Open)

The drainage area of this segment is approximately 91.1 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 56% |
| Open Land | 19% |
| Residential | 13% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

There is a vessel sewage pumpout shoreside facility at Point Independence Yacht Club located on 7th Avenue, Wareham (BBP Undated and DMF 29 January 2003).



There is public access to the Weweantic River via an asphalt boat launch with two ramps and 36 parking spaces. The ramp is maintained by the Wareham DPW (DFWELE 2002).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in the Weweantic River between May and September from 1997 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at five stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al.* 1999). The Weweantic River is home to a freshwater tidal marsh. Protected flora and fauna are associated with this rare habitat. Declines in anadromous fisheries have resulted from physical impediments. Efforts were underway in 1998 to install a fishway and make improvements to the dam at Horseshoe Pond. The Weweantic River was not monitored as intensively as other embayments and full-scale monitoring began in 1997 (Howes *et al.* 1999). The average Health Index Score (1997-2001) for the Inner Weweantic River is 34.8 and for the Outer Weweantic River is 50.8 (CBB Undated b). The Coalition states that the Weweantic River has "fair to poor water quality". The Coalition believes that poor water quality has resulted in the loss of eelgrass beds from the inner region of the Weweantic River. The Coalition suggest that chlorophyll *a* levels indicate periodic blooms and a large phytoplankton community; that nitrogen levels are high; that turbidity is a major cause of eelgrass decline; and that oxygen levels were only "moderately depleted". The Coalition identifies onsite septic systems, cranberry agriculture, and tidal recycling as potential sources of nitrogen (Howes *et al.* 1999).

WMA WATER WITHDRAWAL SUMMARY* (APPENIDX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source G = ground | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|--------------------|--------------------|-------------------|-------------------------|---|-----------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| SEMASS Partnership | 4250007 4250008 | 9P42431001 | | 4250007-01G 4250008-04G Industrial Well A Industrial Well B Industrial Well C | Permitted = 0.33 | 0.19 | 0.23 | 0.25 |

*Excludes any authorized cranberry growers.

There are 8969.409 acres of cranberry bog open space in the Weweantic River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 80.09 MGD. This estimate includes the estimates of water use for the upstream segments MA95-04 and MA95-07.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated wastewater discharges to this segment. Marion, Rochester and Wareham are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their systems over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

At the most upstream end of this segment the Weweantic River Stream Team noted sediment buildup near the Fearing Hill Road bridge in May 2001 and that the sluiceway at the dam was degraded, blocking fish migration and tidal flushing (WRST 2002). Launching of watercraft near Briarwood Beach Point has resulted in deterioration of the bank at that area (WRST 2002).

Eelgrass Bed Habitat

Eelgrass beds in this segment of the Weweantic River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). MA DEP field verified 1999 aerial photography determined that the eelgrass bed identified in 1994 had declined between the Route 6 bridge and the mouth of Beaverdam Creek. A new eelgrass bed was found south of Beaverdam Creek along the west side of Cromeset Neck. Poor water clarity and the presence of sea lettuce (a macroalgae capable of creating nuisance conditions) have also been documented by the Weweantic River Stream Team.

Due to the decline of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for this segment of the Weweantic River. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include septic systems, recreational activities (boating), and operations associated with cranberry bogs.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that areas BB35.0 is approved, BB35.5 is conditionally approved, and BB35.2 is prohibited (DFWELE 2000).

Based on the status of the shellfish growing areas in this segment of the Weweantic River 0.17 mi² are assessed as support, 0.45 mi² are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION






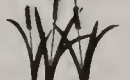
Based on the more stringent shellfish harvesting guidelines the *Primary and Secondary Contact Recreational Uses* are assessed as support for 0.17 mi². The remaining 0.45 mi² are currently not assessed.

AESTHETICS

During their May 2001 shoreline survey the Weweantic River Stream Team reported that there was "oily black mud" on the bottom of the river between 13th Avenue to the Route 6 bridge, Wareham. Water clarity downstream from the Route 6 bridge was estimated as less than two feet and sea lettuce was also evident throughout this area (WRST 2002).

Too limited data are available to assess the *Aesthetics Use*. The use, however, is identified with an Alert Status because of the noted poor water clarity and the presence of sea lettuce.

Weweantic River (MA95-05) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|------------------------|---|---|---|----------------|---------|---|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (decline of eelgrass bed habitat) | Total nitrogen | | On-site treatment systems (septic systems), specialty crop production related to cranberry bogs, recreational activities (boat traffic) |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting** |  | 0.17 mi ² SUPPORT 0.45 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | Municipal separate storm sewer systems, on-site treatment systems (septic systems) |
| Primary Contact |  | 0.17 mi ² SUPPORT 0.45 mi ² NOT ASSESSED | | | | |
| Secondary Contact |  | 0.17 mi ² SUPPORT 0.45 mi ² NOT ASSESSED | | | | |
| Aesthetics* |  | NOT ASSESSED | | | | |

*Alert Status issues identified – see details in use assessment section.

**For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS WEWEANTIC RIVER (MA95-05)

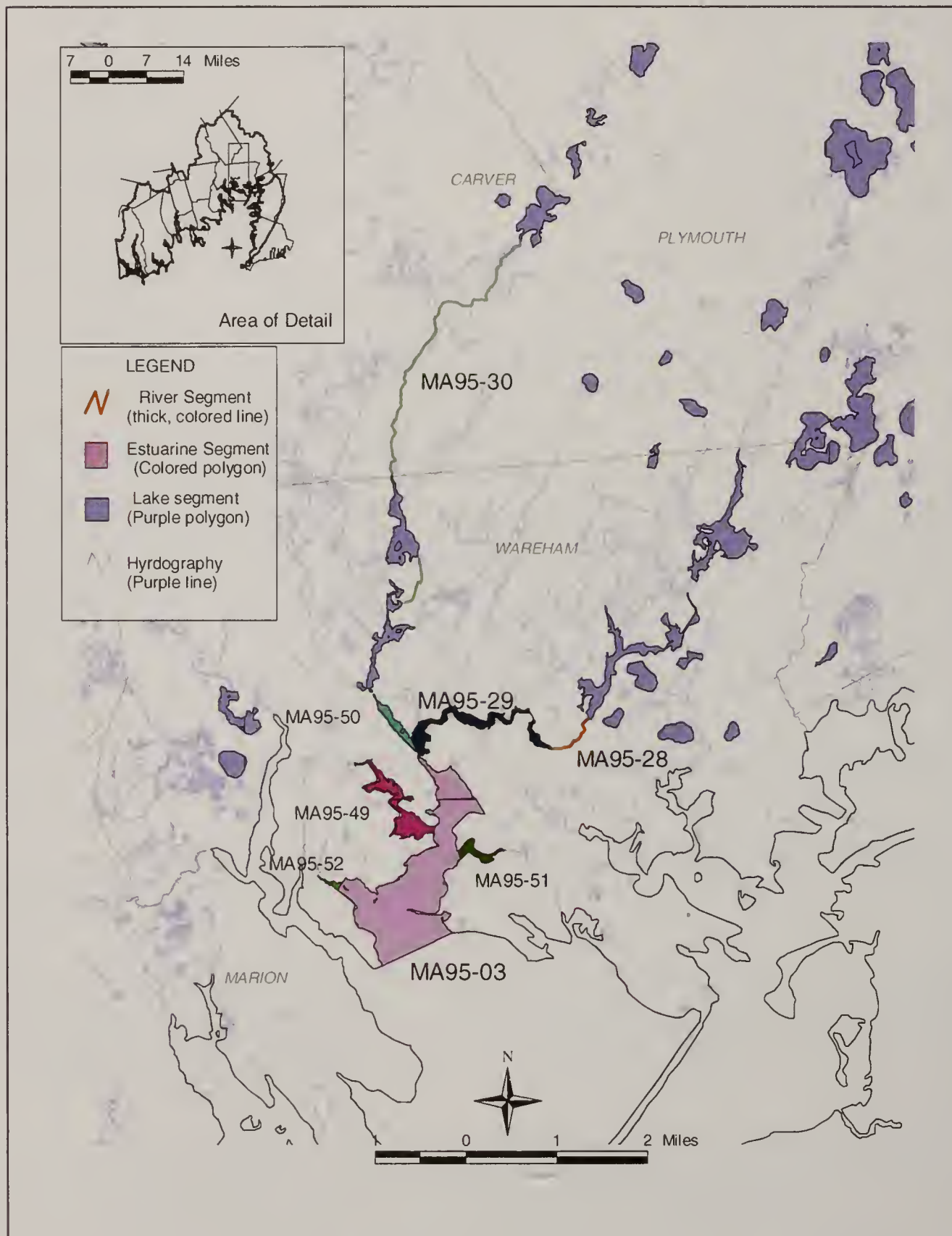
- The Weweantic River Stream Team identified sediment deposition in this segment of the Weweantic River near Horseshoe Pond Dam. As part of a shoreline survey, evaluate the extent of sedimentation problems in this subwatershed and determine the source of sediment buildup (most likely storm water related). Conduct biomonitoring in this subwatershed bracketing these nonpoint sources to determine if sedimentation and/or other nutrient inputs negatively affect the aquatic life. Conduct bacteria monitoring to determine if road runoff is a source of bacteria to this segment and to assess the recreational uses. As a follow up to the survey(s), determine the need to implement erosion control measures and best management practices, remediate drains, and remove sediment buildup. Additionally, work to improve fish passage at the Horseshoe Pond Dam.
- Work with the Weweantic River Stream Team to implement their recommendations to improve the aesthetics of this subwatershed.
- Develop a bacteria monitoring program to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and/or the Phase II community storm water management programs.
- DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juveniles. DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of the aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data for use in evaluating the status of the *Aquatic Life Use*.

- Evaluate and remedy bank erosion at the boat ramp near Briarwood Beach Point which may be detrimental to the aquatic life.
- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WH21, WH01, WH01b, WH29, and WH33. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.

THE WAREHAM RIVER DRAINAGE AREA

The Wareham River Drainage Area in Wareham includes two main freshwater tributaries (the Agawam and Wankinco Rivers), two smaller tributaries to the tidal portion (Broad Marsh and Crooked River) and a tributary to Marks Cove (Cedar Island Creek).

- Agawam River (Segment MA95-28)
- Agawam River (Segment MA95-29)
- Wankinco River (Segment MA95-30)
- Wankinco River (Segment MA95-50)
- Broad Marsh River (MA95-49)
- Crooked River (MA95-51)
- Cedar Island Creek (MA95-52)
- Wareham River (Segment MA95-03)



AGAWAM RIVER (SEGMENT MA95-28)

Location: Outlet Mill Pond, Wareham to Wareham WWTP, Wareham

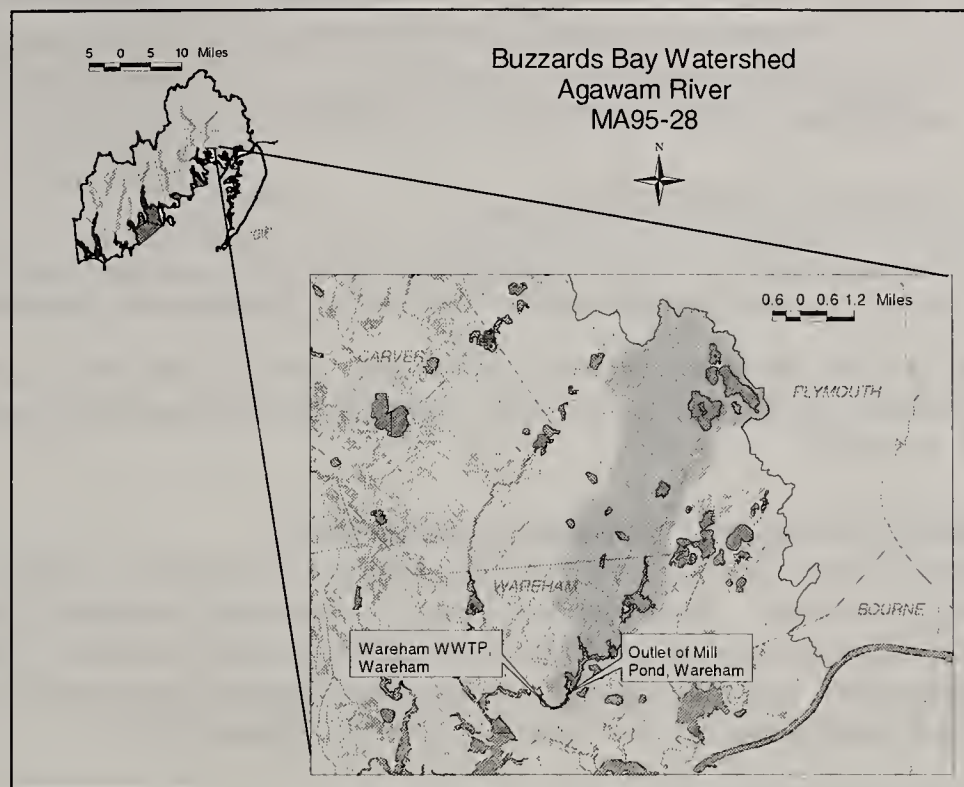
Segment Length: 0.60 miles.

Classification: Class B, Warm Water Fishery

The drainage area of this segment is approximately 17.144 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 71% |
| Open Land | 10% |
| Residential | 7% |

The use assessments of ten lakes located in this subwatershed (Little Long, Long, Gallows, Halfway, Round, Fawn, Abner, Five Mile, Glen Charlie, and Mill ponds) are provided in the Lakes Assessment section of this report.



In 2001 MassWildlife stocked trout in the Agawam River for recreational fishing (DFWELE 24 September 2002). On 25 August 1999 DFWELE conducted fish population sampling upstream of this segment (below Stump Pond Latitude: 41.8072059 Longitude: 70.6439405) using backpack electrofishing gear. Fish species collected in order of abundance included American eel, alewife, largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), tessellated darter (*Etheostoma olmstedii*), chain pickerel, bluegill, brown bullhead, black crappie, and yellow perch (Hurley 2003).

From 1997-2001 the Buzzards Bay Project conducted a 319 project to demonstrate that proactive land conservation is a viable tool for nitrogen management through the use of conservation restrictions, outright land purchase, and agricultural preservation restrictions. Thirteen acres in the upper portion of the Agawam River were placed under conservation restriction protecting rare damselflies habitat, freshwater mussel beds, and a quaking sphagnum bog. Additionally, four acres were protected for the public drinking water supply (BBP 1997-2001).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in this segment of the Agawam River between May and September from 1998 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Havens et al. 1999). (See segment MA95-29, the estuarine segment of the Agawam River, for more information.)

As part of the Town of Wareham WWTP Massachusetts Environmental Policy Act process, Camp Dresser & McKee (CDM) conducted a water quality investigation of the Wareham River Estuary Complex (CDM 2000). CDM collected river stage measurements in the Agawam River just downstream of the Mill Pond. Tide heights were recorded at four sites throughout the estuary complex. Nutrient sampling was conducted between 5 April and 5 November 1999 at one site in the Agawam River near the river stage transducer site "but on the branch associated with the herring run and one of the dam overflows" (CDM 2000). Conductivity, temperature, depth, and dissolved oxygen were also sampled *in situ* on four occasions between 11 August and 26 September 1999.

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------------|---------|-------------------|-------------------------|---|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Wareham Fire District** | 4310000 | 9P42431002 | 42431012 | 4310000-01G 4310000-03G 4310000-04G 4310000-05G 4310000-06G | Registered = 1.31 Permitted = 0.46 (1999 & 2000) Permitted = 0.56 (2001) | 1.72 | 1.63 | 1.66 |

*Excludes any authorized cranberry growers.

**Wareham Fire District has seven withdrawal points in the Buzzards Bay Basin – five in Segment MA95-28 and two in Segment MA95-29. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined.

There are 608.956 acres of cranberry bog open space in the Agawam River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 5.44 MGD.

NPDES SURFACE DISCHARGE SUMMARY

Based on the available information there are no regulated surface discharges to this segment of the Agawam River. Wareham is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow





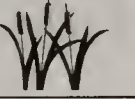
The Agawam River supports one of the most prolific herring runs within Buzzards Bay. A fish ladder (a weir pool) is maintained at the Mill Pond Dam to allow herring passage to the spawning grounds north of the dam to Halfway Pond in Plymouth.

AD Makepeace Company owns and operates a stop log station at the Route 12 bridge just downstream of Mill Pond on this segment of the Agawam River. Stop log activity occurs during the winter (December–March) when the cranberry bogs are flooded to avoid frost damage, thus reducing river flows. In mid-March stop logs are removed and excess water is released, increasing river flows. Between mid-May and August stop logs are installed to allow the application of pesticides and fertilizers and then removed. Between mid-September and early October the bogs are flooded for harvesting. Additionally, stop logs are manipulated following precipitation events. Stop log activity during 1999 in the Agawam River was not recorded by AD Makepeace (CDM 2001b).

Flows in the Agawam River as reported by CDM between 28 April and 4 November 1999 (a drought year [USGS 5 June 2001]) ranged between 5.12 and 70.77 cfs (n=382). The average annual flow in the Agawam River (extrapolated by CDM from their 7 months of monitoring) was 27.6 cfs and based on additional monitoring the average annual flow was 30.5 cfs. The 7Q10 for the Agawam River as calculated in the 1999 Wareham WWTP NPDES permit is 10.8 cfs (CDM 2000).

Too limited data are available, and, therefore, the *Aquatic Life Use* is not assessed for this segment of the Agawam River. This use is, however, identified with an Alert Status because of flow and fish passage concerns.

Agawam River (MA95-28) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|--|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified – see details in the use assessment section.

RECOMMENDATIONS AGAWAM RIVER (MA95-28)

- DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juveniles. DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of aquatic life.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.

AGAWAM RIVER (SEGMENT MA95-29)

Location: From the Wareham WWTP to confluence with Wankinco River at the Route 6 bridge, Wareham

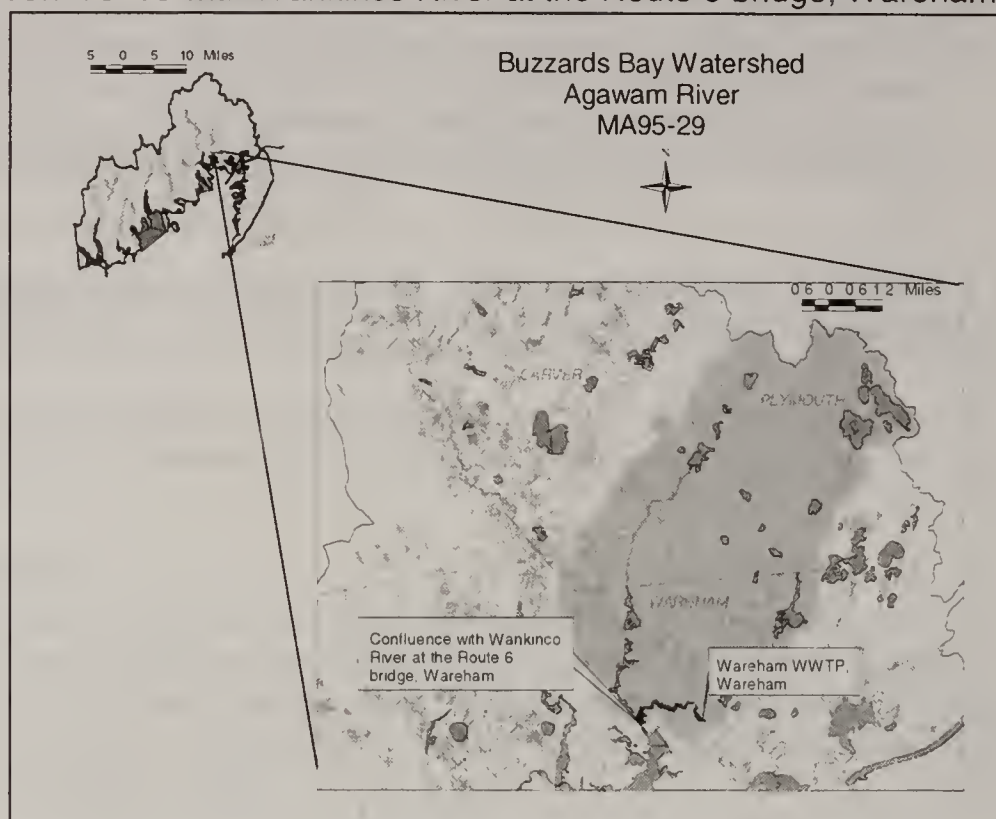
Segment Area: 0.16 square miles

Classification: Class SB, Shellfishing (Restricted)

The drainage area of this segment is approximately 41.4 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 69% |
| Open Land | 16% |
| Residential | 5% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens, nutrients, noxious aquatic plants and other habitat alterations (MA DEP 1999).



As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.

As part of the Massachusetts Environmental Policy Act process Camp Dresser & McKee (CDM) conducted a water quality investigation of the Wareham River Estuary Complex (CDM 2000). Tide heights were recorded at four sties throughout the estuary complex. Conductivity, temperature, depth, and dissolved oxygen were also sampled *in situ* on four occasions between 11 August and 26 September 1999.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in this segment of the Agawam River between May and September from 1998 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Marks Cove, included in this segment, was sampled for nutrients at three stations. The Agawam River "currently supports one of the most prolific herring runs within Buzzards Bay". The Agawam River is one of the most "heavily nutrient-loaded" estuaries in Buzzards Bay (Howes *et al* 1999). Health Index Scores for the Agawam River have consistently been in the "poor" category with an average score of 16.5. Water quality degradation in the Agawam River is attributed to nutrient discharges from the Wareham WWTP. Nitrogen and chlorophyll *a* concentrations are only elevated between the plant and the confluence with the Wankinco River. Dissolved oxygen concentrations consistently dropped to stressful conditions (defined by CCB as <60% saturation) within this segment of the Agawam River. The low DOs are associated with organic matter production stimulated by the high nutrients, oxidation of ammonium from the WWTF, and the decay of organic matter from the surrounding salt marshes (CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------------|---------|-------------------|-------------------------|----------------------------|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Wareham Fire District** | 4310000 | 9P42431002 | 42431012 | 4310000-02G 4310000-07G | Registered = 1.31 Permitted = 0.46 (1999 & 2000) Permitted = 0.56 (2001) | 1.72 | 1.63 | 1.66 |

*Excludes any authorized cranberry growers.

**Wareham Fire District has seven withdrawal points in the Buzzards Bay Basin – five in Segment MA95-28 and two in Segment MA95-29. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all seven sources combined.

There are 2792.008 acres of cranberry bog open space in the Agawam River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 24.93 MGD. This estimate includes estimates of water use for the upstream segments MA95-28 and MA95-30. An estimate of water use for the bog area contained exclusively in segment MA95-29 is 3.68 MGD.

NPDES SURFACE DISCHARGE SUMMARY

The Town of Wareham (MA0101893) is permitted (30 October 1991) to discharge 1.8 MGD of treated sanitary wastewater via outfalls 001-004 to the Agawam River. The facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent and $C-NOEC \geq 14\%$ effluent. This facility's permit is currently in the process of being renewed. EPA has issued the draft permit for public comment with a decrease in flow to 1.47 MGD and seasonal nitrogen limit of 4.0 mg/L. It is likely that the final permit will have a flow limit of 1.57 MGD, as the I/I calculation was incorrect. Wareham plans to upgrade the WPCF to include a new headworks facility with a new septage receiving system, two flow equalization basins, a new biological nutrient removal process, a UV disinfection system, a biofiltration odor control system, one new 18" outfall pipe, and a new solids thickening process. Additionally, the Town plans to extend the sewer to 12 "needs" areas. The facility, operational since 1972, currently provides secondary treatment through conventional activated sludge processes followed by disinfection and filtration (CDM 2001a and 2001b).

It should also be noted that Wareham is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT**AQUATIC LIFE**ToxicityEffluent

The Town of Wareham conducted 27 whole effluent toxicity tests using the mysid shrimp, *M. bahia* and the inland silverside, *M. beryllina* between April 1996 and August 2002. With the exception of one test (August 2001 $LC_{50} = 85\%$) the effluent was not acutely toxic to the mysid. However, the effluent was acutely toxic to *M. beryllina* in ten of the 27 test events (LC_{50} 's ranged between 57.5 and $>100\%$ effluent). The facility did meet the C-NOEC permit limit of 14% effluent in all tests (range 14-100% effluent).

Ambient

The Town of Wareham collects Agawam River water downstream from the WWTP discharge at the Route 6 bridge (closest to their discharge) in Wareham for use as dilution water in their whole effluent toxicity tests. Between April 1996 and August 2002 survival of *M. bahia* exposed to the river water (48-hours) was good (not less than 90%) and *M. beryllina* was good (not less than 93% at 7-day exposure).

Chemistry-water

The Town of Wareham collects Agawam River water downstream from the WWTP discharge at the Route 6 bridge (closest to their discharge) in Wareham for use as dilution water in their whole effluent toxicity tests. Ambient chemical analysis included pH, TSS, and ammonia.

pH

pH values reported in the Wareham toxicity reports ranged between 6.4 and 9.0 SU (one less than 6.5; 14 greater than 8.5 SU) n=28.

Ammonia (as N)

Ammonia concentrations reported by Wareham ranged from BDL to 0.520 mg/L (n=27). A conservative total ammonia chronic criterion for this segment is 0.10 mg/L (estimated using a pH of 9.0 SU [Wareham TOXTD], a maximum temperature of 23.8°C and a low salinity of 10 ppt [CDM 2000]). Nineteen of 27 measurements exceeded this conservative criterion.

Total Suspended Solids

TSS concentrations in the samples collected by Wareham for their toxicity tests ranged from <2 to 27.50 mg/L (n=27). However, only one measurement exceeded 25 mg/L.







Based on elevated ammonia-nitrogen concentrations and the presence of acute toxicity in the Agawam WWTP discharge, the *Aquatic Life Use* is assessed as impaired in this segment of the Agawam River. This assessment is corroborated by the findings of the Coalition for Buzzards Bay, which claim this river is one of the most "heavily nutrient-loaded" estuaries in Buzzards Bay (Howes *et al* 1999). It should be noted, however, that the WWTP is undergoing a facility upgrade that will include a new biological nutrient removal process. Additional potential sources of nutrients include cranberry bog operations and on-site septic systems.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that area BB36.3 is prohibited (DFWELE 2000).

Because of the DMF shellfish growing area closure the *Shellfish Harvesting Use* for this segment (0.16mi²) is assessed as impaired.

Agawam River (MA95-29) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|----------------------|---|--------------|--|----------------------------------|---|
| | | | Known | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Ammonia (unionized), whole effluent toxicity | Municipal point source discharge | Irrigated, specialty crop production related to cranberry bogs and on-site treatment systems (septic systems) |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems, municipal point source discharge |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

RECOMMENDATIONS AGAWAM RIVER (MA95-29)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring to continue to assess the *Aquatic Life Use*.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.
- Continue to monitor nutrient levels to document effectiveness of source reduction activities including upgrade of the Wareham WWTP, treatment of storm water discharges, sewerage, and the Phase II community storm water management programs. Continue to work with the cranberry bog growers association to improve best management practices to reduce nutrient loading from fertilizer applications. Review the results of the on-going nutrient study *Cranberry Bog Phosphorus Dynamics TMDL Project* (DeMoranville 2001).
- If the Wareham WWTP continues to have problems meeting the whole effluent toxicity limits after the facility upgrade, the Town should be required to conduct a toxicity identification and reduction evaluation (TIE/TRE). Continue to review toxicity reports to evaluate the *Aquatic Life Use*.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacteria inputs and reopen shellfish beds.
- Implement the four salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WH16, WH17, WH25, and WH26. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

WANKINCO RIVER (SEGMENT MA95-30)

Location: Outlet East Head Pond following the border of Carver/Plymouth through cranberry bogs to Elm Street bridge, Wareham

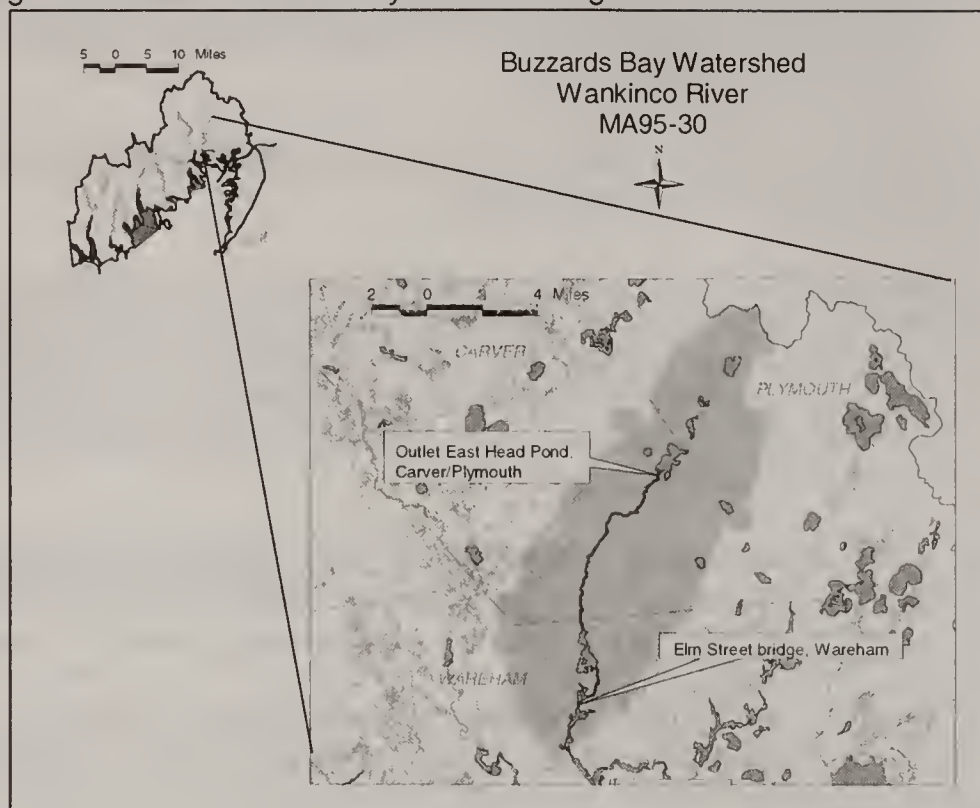
Segment Length: 6.40 miles

Classification: Class B

The drainage area of this segment is approximately 20.6 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|------------|------|
| Forest | 72% |
| Open Land | 19 % |
| Commercial | 1% |

The use assessments of nine lakes (College, Three Cornered, New Long, East Head, Barrett, Fearing, Charge, Tihonet, and Parker Mills ponds) that are located in the drainage area of this segment are provided in the Lakes Assessment section of this report.



As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.

AD Makepeace will be constructing a 35-lot subdivision on 60 acres located between Farm-to-Market Road and Tihonet Pond. The proposed individual septic systems will include a "denitrification" removal system so the 35 lots should release 16 to 34 percent less nitrogen per acre than typical septic systems.

The Carver/Marion/Wareham Ash landfill is located along this segment of the Wankinco River (MA DEP BWP 2000).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 1770.557 acres of cranberry bog open space in the Wankinco River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 15.81 MGD.

NPDES SURFACE DISCHARGE SUMMARY

Tremont Nail Company (MA0005801) is permitted (18 February 1986) to discharge 60,000 gpd of contact cooling water from heat quench tanks via outfall 001 to the Wankinco River. The permit includes an 81°F temperature limit and also includes secondary limits for TSS= 20 mg/L, oil & grease = 15 mg/L and total iron =2.0 mg/L (dissolved iron = 1.0 mg/L).

It should also be noted that Carver, Plymouth, and Wareham are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their systems over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow






The Wankinco River supports a herring run within Buzzards Bay. There are two denil fish ladders maintained at Tihonet and Parker Mill ponds to allow herring passage to the spawning grounds.

AD Makepeace Company owns and operates a stop log station on this segment of the Wankinco River. Stop log activity occurs during the winter (December –March) when the cranberry bogs are flooded and allowed to freeze, thus reducing river flows. In mid-March stop logs are removed and excess water is released, increasing river flows. Between mid-May and August stop logs are installed to allow the application of pesticides and fertilizers and then removed. Between mid-September and early October the bogs are flooded for harvesting. Additionally, stop logs are manipulated following precipitation events. During 1999 stop log activity in the Wankinco ranged from 14 per month to 5 per month (CDM 2001b).

Flows in the Wankinco River as reported by CDM between 28 April and 4 November 1999 (n=382) ranged between 1.89 and 133.49 cfs (CDM 2000). The average annual flow in the Wankinco River (extrapolated by CDM from their 7 months of monitoring) was 30.6 cfs. Based on additional monitoring the average annual flow was 29.3 cfs (CDM 2001b). It should be noted that 1999 was a drought year (USGS 5 June 2000). An estimated 7Q10 for the Wankinco River at Wareham, MA, 1000 feet below Parker Mills Pond is 8.0 cfs (Wandell and Morgan 1984).

Too limited data are available, and, therefore, the *Aquatic Life Use* is not assessed for this segment of the Wankinco River. The use is, however, identified with an Alert Status because of flow and fish passage concerns.

Wankinco River (MA95-30) Use Summary Table

| Aquatic Life* | Fish Consumption | Primary Contact | Secondary Contact | Aesthetics |
|---|---|--|---|---|
|  |  |  |  |  |
| NOT ASSESSED | | | | |

* Alert Status issues identified – see details in the use assessment section

RECOMMENDATIONS WANKINCO RIVER (MA95-30)

- DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juveniles. DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data for assessing the *Aquatic Life Use*.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.

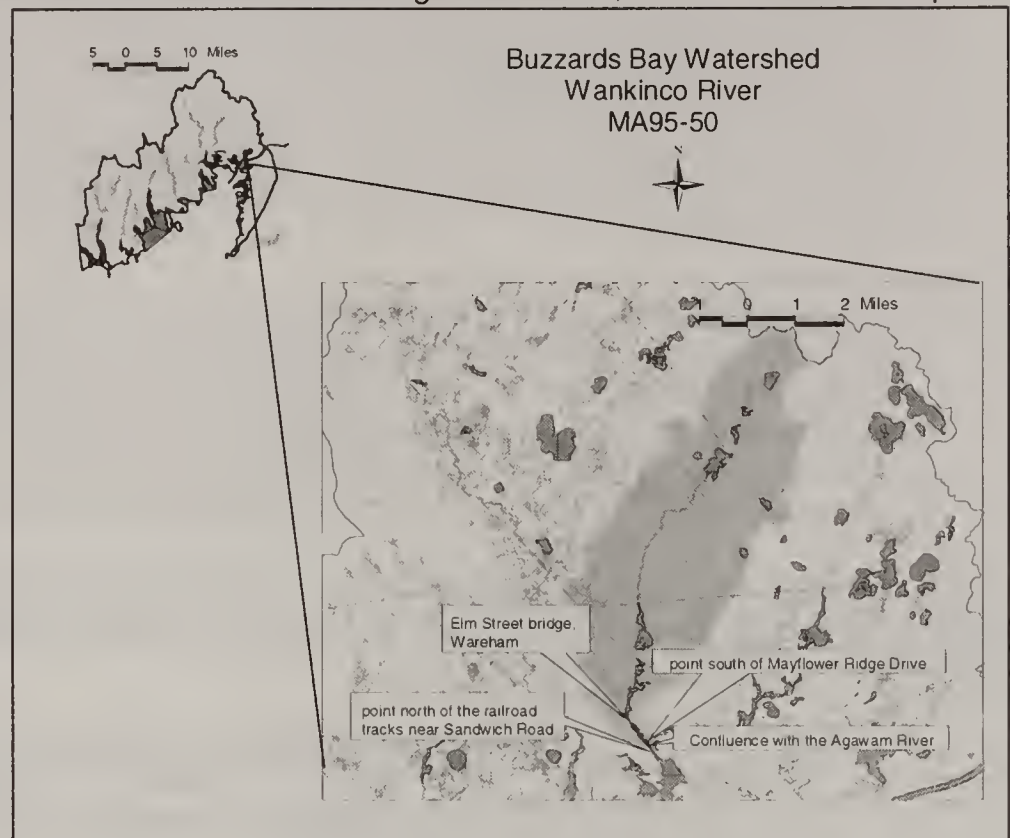
WANKINCO RIVER (SEGMENT MA95-50)

Location: Elm Street bridge, Wareham to the confluence with the Agawam River, at a line between a point south of Mayflower Ridge Drive and a point north of the railroad tracks near Sandwich Road, Wareham
Segment Area: 0.05 square miles
Classification: Class SA

The drainage area of this segment is approximately 20.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 72% |
| Open Land | 19% |
| Residential | 2% |

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.



The Coalition for Buzzards Bay conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in this segment of the Wankinco River between May and September 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al.* 1999).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are no regulated water withdrawals from this subwatershed. There are, however, 1770.557 acres of cranberry bog open space located upstream from this segment in the subwatershed of segment MA95-30.

NPDES SURFACE DISCHARGE SUMMARY

There are no known surface NPDES discharges to this segment of the Wankinco River. It should be noted that Wareham is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).







USE ASSESSMENT

SHELLFISHING

The DMF Shellfish Status Report of July 2000 indicates that area BB36.3, which encompasses this entire segment, is prohibited (DFWELE 2000).

Based on the DMF shellfish status report the *Shellfish Harvesting Use* is assessed as impaired for this entire segment of the Wankinco River (0.05 mi²).

Wankinco River (MA95-50) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

RECOMMENDATIONS WANKINCO RIVER (MA95-50)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to mitigate bacterial contamination and reopen shellfish beds. Continue to review the shellfish status report to assess the *Shellfish Harvesting Use*.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.

BROAD MARSH RIVER (SSEGMENT MA95-49)

Location: From its headwaters in a salt marsh south of Marion Road and Bourne Terrace, Wareham to the confluence with the Wareham River, Wareham (at a line consistent with DMF DSGA BB36.8)

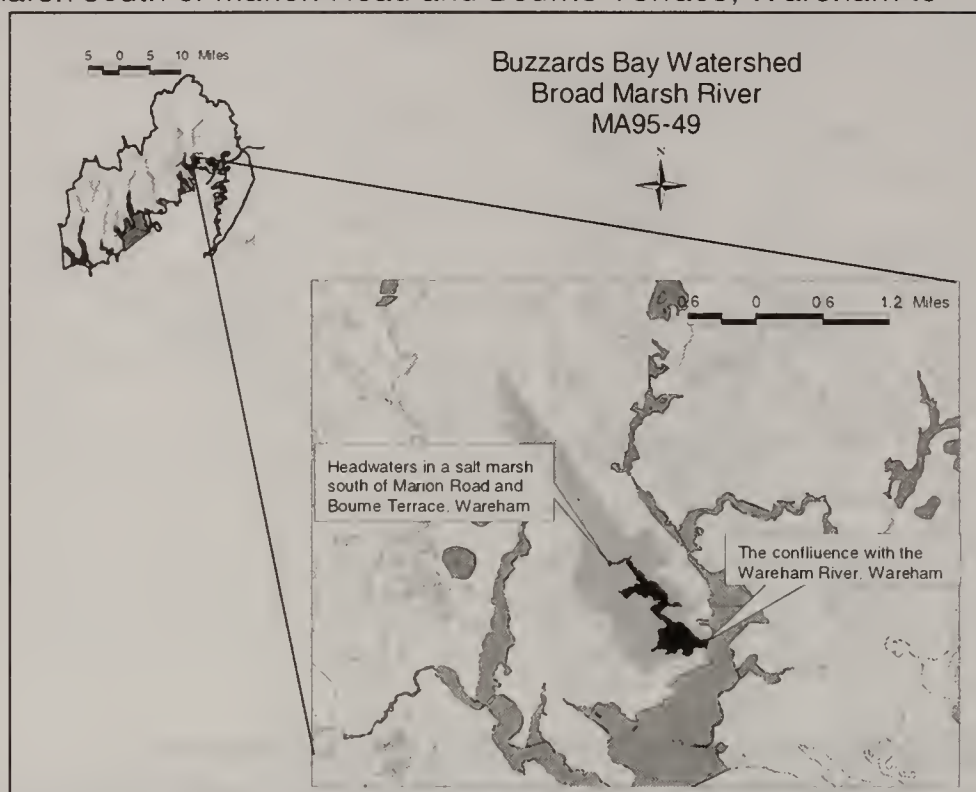
Segment Area: 0.16 square miles

Classification: Class SA

The drainage area of this segment is approximately 1.2 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 41% |
| Residential | 29% |
| Wetlands | 13% |

The Broad Marsh River estuary is approximately 100 acres in size and contains large softshell clam and quahog resources. There is a Town owned and operated bathing beach as well as private beaches on the river's shore. Storm water runoff from 15 storm drain pipes discharges directly to the river resulting in the closure of shellfish growing areas and posing potential human health risks. In 1990 the Broad Marsh Stormwater Remediation Project was begun by the Town of Wareham utilizing MA DEP s.319 funds and assistance from BBP. The project installed subsurface concrete and plastic infiltration structures at 15 sites and was completed in April 1996. Post-project monitoring indicated that >99.99% of fecal coliform bacteria was removed from runoff and as a result, shellfish growing areas were reclassified as "conditionally approved" (EPA 31 December 2002).



The Coalition for Buzzards Bay have been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in Broad Marsh River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at six stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll a (Howes *et al* 1999). The Broad Marsh River has been classified as having "fair" water quality based on the Health Index Scores. The average score for 1997-2001 is 50.9 (CBB Undated b). Eelgrass beds historically existed up to the mouth of Broad Marsh River. Upper and lower Broad Marsh River show elevated nitrogen and chlorophyll a levels. Dissolved oxygen concentrations in Broad Marsh River rarely showed moderately stressful oxygen levels (defined by CBB as less than 60% saturation). According to the Coalition, factors contributing to the fair health index are the relatively dense development in a small sub-watershed, extensive marsh area, and restricted tidal flushing (Howes *et al.* 1999).

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F) AND NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or discharges in this subwatershed. However, it should also be noted that Wareham is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that areas BB36.11 and BB36.9 are prohibited and BB36.8 is conditionally approved (DFWELE 2000).







Based on the status of the shellfish growing areas in Broad Marsh River this entire segment (0.16 mi²) is assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

There is a Town owned and operated bathing beach as well as private beaches on the river's shore. According to the Wareham Board of Health Office there have been no closures at the Broad Marsh River beach. (Wareham BOH 2003) The Broad Marsh Stormwater Remediation Project was completed in April 1996. Post project monitoring indicated that >99.99% of fecal coliform bacteria was removed from runoff.

Based on too limited data, the *Primary* and *Secondary Contact Recreational Uses* are not assessed.

Broad Marsh River (MA95-49) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS BROAD MARSH RIVER (MA95-49)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Develop and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses. Continue to review the closure information/data from the beach bill to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to mitigate contaminants causing shellfish bed closures. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the two salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town (Site WH28 and WH36). Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.

CROOKED RIVER (SEGMENT MA95-51)

Location: From the outlet of a cranberry bog, east of Indian Neck Road, Wareham to confluence with the Wareham River, Wareham

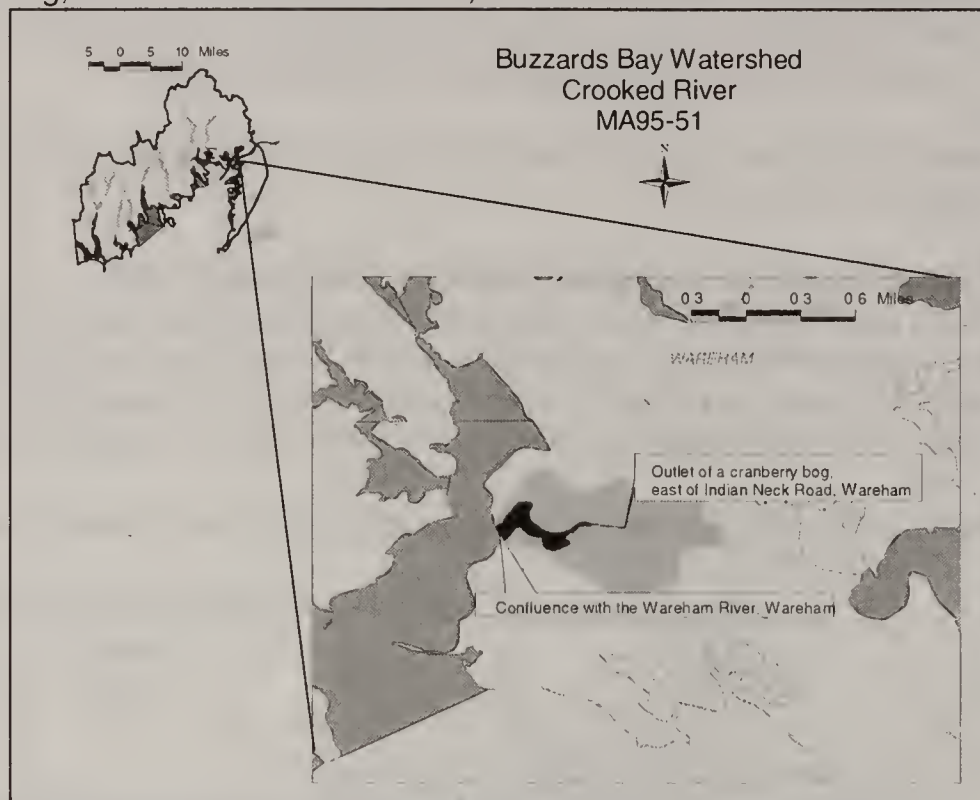
Segment Area: 0.04 square miles

Classification: Class SA

The drainage area of this segment is approximately 0.5 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 48% |
| Residential | 33% |
| Open Land | 711 |

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.



WMA WATER WITHDRAWAL SUMMARY (APPENDIX F) AND NPDES SURFACE DISCHARGE SUMMARY

There are no known regulated water withdrawals or NPDES discharges to Crooked River. Wareham, however, is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

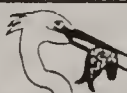

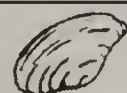



USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that area BB36.1 is prohibited (DFWELE 2000).

Based on the status of the shellfish growing areas in the Crooked River this entire segment (0.04 mi²) is assessed as impaired.

Crooked River (MA95-51) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E

RECOMMENDATIONS CROOKED RIVER (MA95-51)

- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacterial inputs and possibly reopen shellfish beds. Continue to review the DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the five salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WH10, WH11, WH23, WH34 and WH35. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.

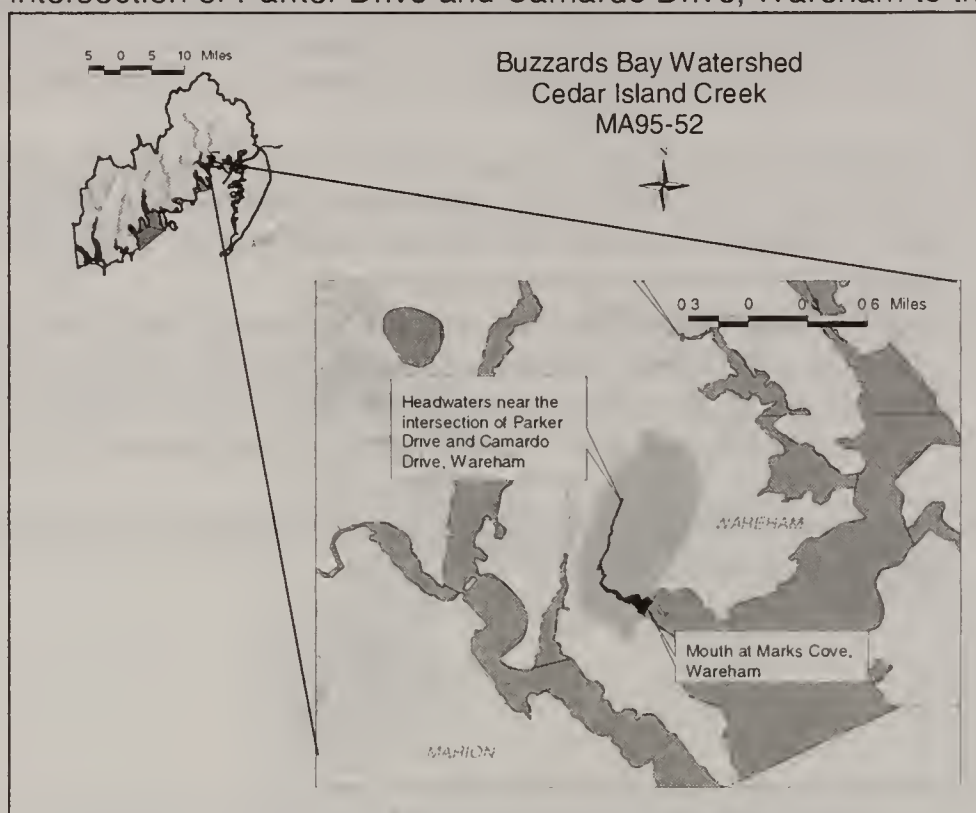
CEDAR ISLAND CREEK (MA95-52)

Location: From the headwaters near the intersection of Parker Drive and Camardo Drive, Wareham to the mouth at Marks Cove, Wareham (consistent with DMF DSGA BB36.7)
Segment Area: 0.01 square miles
Classification: Class SA

The drainage area of this segment is approximately 0.4 square miles.
Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 52% |
| Residential | 20% |
| Wetlands | 19% |

As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.



WMA WATER WITHDRAWAL SUMMARY AND NPDES SURFACE DISCHARGE SUMMARY

Based on available information there are no regulated water withdrawals or discharges to Cedar Island Creek. Wareham is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

SHELLFISH HARVESTING







The DMF Shellfish Status Report of July 2000 indicates that areas BB36.7 and BB36.4 are prohibited and BB36.21 and BB36.0 are approved (DFWELE 2000).

Based on the status of the shellfish growing areas in the Cedar Island Creek, 0.006 mi² are assessed as impaired and 0.004 mi² are assessed as support. Therefore, this 0.01 mi² segment is reported as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

Based on the more stringent shellfish harvesting guidelines the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.004 mi². The remaining 0.006 mi² are currently not assessed. Therefore, this 0.01 mi² segment is reported as not assessed.

Cedar Island Creek (MA95-52) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS CEDAR ISLAND CREEK (MA95-52)

- Develop a plan to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacterial inputs to Cedar Island Creek and possibly reopen closed shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.

WAREHAM RIVER (SEGMENT MA95-03)

Location: Route 6 bridge to mouth at Buzzards Bay (at an imaginary line from Cromset Point to curved point east, southeast of Long Beach Point), Wareham. Includes Mark's Cove, Wareham

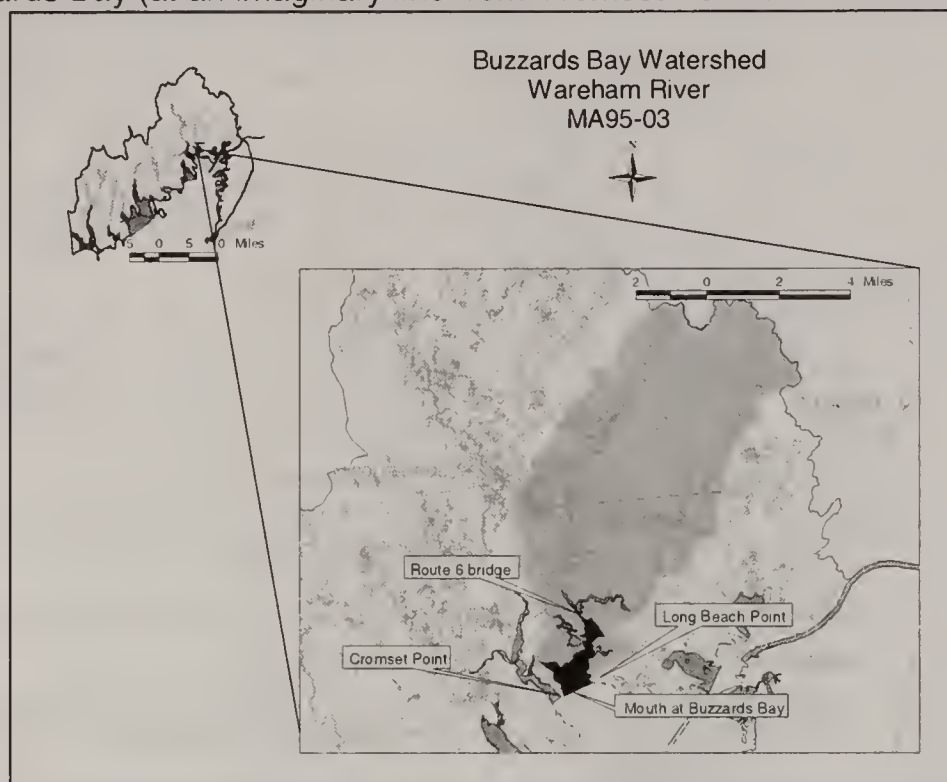
Segment Area: 1.18 square miles

Classification: Class SA, Shellfishing (Open)

The drainage area of this segment is approximately 44.8 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 67% |
| Open Land | 15% |
| Residential | 7% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



As part of the Massachusetts Estuaries Project a nutrient and bacteria TMDL will be developed by SMAST in the next few years for the Wareham River System, which encompasses this segment.

There is public access to the Wareham River at Tempest Knob. This site has one concrete boat launch with 36 parking spaces. A fee is charged and/or a sticker is required (DFWELE 2002). Additionally, the Wareham River Fishing Pier, maintained by the Town, offers anglers a chance to catch fluke, bluefish, and striped bass (DFWELE 2002). There is a vessel sewage pump-out facility, pump-out boat, and porta-potty dump at Warr's Marine located on Lower Main Street, Wareham (BBP Undated and DMF 29 January 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in this segment of the Wareham River between May and September from 1992 to the present. Samples were collected between 6 and 9 am. More intensive sampling of nutrients was conducted at seven stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Marks Cove was sampled for nutrients at three stations. The Wareham River Estuary receives the flow from the Agawam, Wankinco, and Weweantic rivers and is "subject to the greatest surface freshwater flows in all of the sub-embayments to Buzzards Bay" (Howes *et al.* 1999). The Health Index Scores for the Wareham River are Fair (35-65); the average score for the "inner river" between 1997 and 2001 was 40.8 and Wareham "outer river" was 47.1 (CBB Undated b). The Wareham River complex is "nitrogen enriched and experiencing moderate-high nutrient related water quality decline". The Coalition states that total nitrogen and chlorophyll *a* concentrations are moderately high and oxygen concentrations throughout the Wareham River Estuary were "only moderately depressed" (Howes *et al.* 1999).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 2842.489 acres of cranberry bog open space in the Wareham River subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for these bog areas is 25.38 MGD. This estimate includes the estimate of water use for the upstream segment MA95-29. An estimate of water use for the bog area contained exclusively in segment MA95-03 is 0.45 MGD.

NPDES SURFACE DISCHARGE SUMMARY

Based on available information there are no regulated discharges to this segment of the Wareham River. It should, however, be noted that Wareham is a Phase II community and has submitted their Notice Of Intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

Eelgrass beds in this segment of the Weweantic River were mapped by MA DEP from field verified 1994 aerial photography (Costello 2003). MA DEP field verified 2002 aerial photography determined that the eelgrass bed identified in 1994 along the eastern side of this segment near Oak Street had declined and that the beds were sparse with dense epiphytes. Costello also identified that algae was dense near Crab Cove and the Parkwood Beach area and a floating mat was identified near Wareham Neck.

Because of the decline of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for this segment of the Wareham River. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include recreational activities (boating) and septic systems.

SHELLFISH HARVESTING







The DMF Shellfish Status Report of July 2000 indicates that areas BB33.0, BB36.0, BB36.20, and BB36.21 are approved, and BB36.3, BB36.4 and BB36.5 are prohibited (DFWELE 2000).

Based on the status of the shellfish growing areas in the Wareham River 0.93 mi² are assessed as support and 0.25 mi² are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

Based on the more stringent shellfish harvesting guidelines the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.93 mi². The remaining 0.25 mi² are currently not assessed.

Wareham River (MA95-03) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|---|---|----------------|----------------------------------|---|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (decline of eelgrass bed habitat) | Total nitrogen | Municipal point source discharge | On-site treatment systems (septic systems), specialty crop production related to cranberry bogs |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 0.93 mi ² SUPPORT 0.25 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | Municipal separate storm sewer systems |
| Primary Contact |  | 0.93 mi ² SUPPORT 0.25 mi ² NOT ASSESSED | | | | |
| Secondary Contact |  | 0.93 mi ² SUPPORT 0.25 mi ² NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS WAREHAM RIVER (MA95-03)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce pollution inputs to this segment of the Wareham River. Continue to review the DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Implement the six salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WH12, WH13, WH14, WH14b, WH15 and WH24. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data for use in assessing the *Aquatic Life Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.
- Develop a nutrient/bacteria TMDL for the Wareham River system in accordance with the Massachusetts Estuaries Project.

ONSET BAY (SEGMENT MA95-02)

Location: Wareham

Segment Area: 0.78 square miles

Classification: Class SA

The drainage area of this segment is approximately 4.9 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 43% |
| Residential | 26% |
| Open Land | 11% |

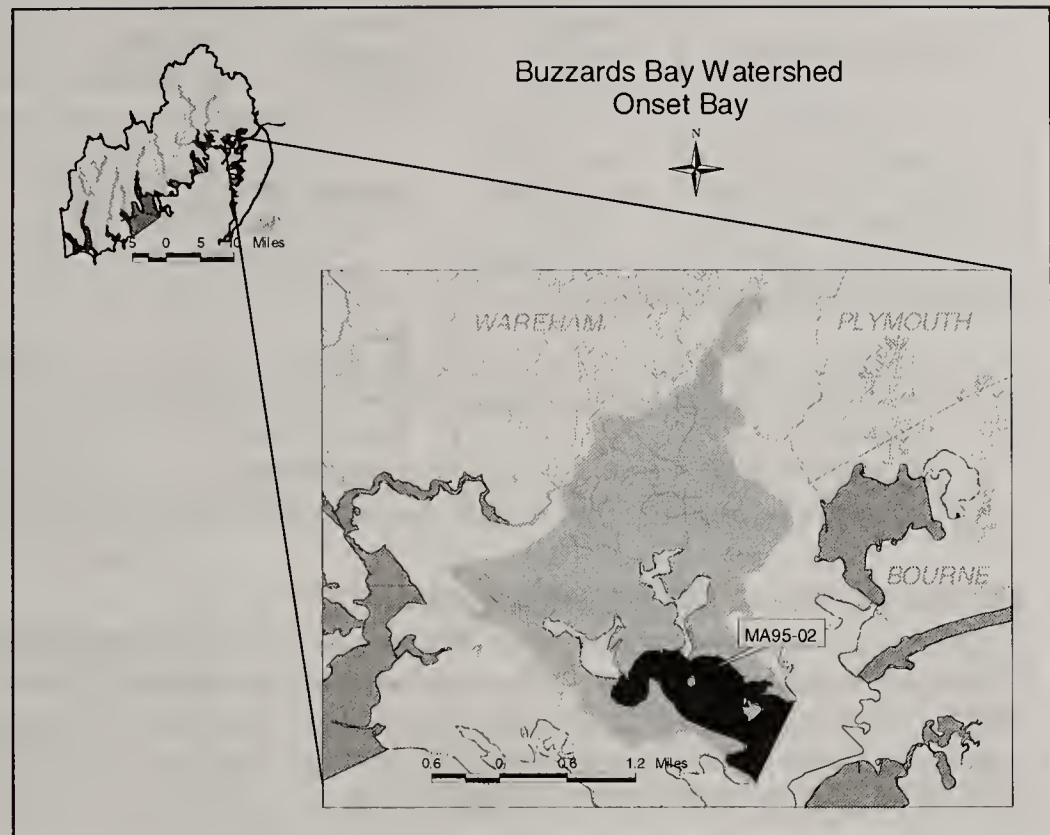
This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

The use assessments of Sandy, Spectacle, Union, Dicks, and Sand ponds, which are located in the subwatershed of Onset Bay, are provided in the Lakes Assessment section of this report.

There are three vessel sewage pumpout facilities located on Onset Bay; Onset Bay Marina at Green Onset, Stonebridge Marina at East Boulevard, and the Onset Town Pier at Onset Avenue (BBP undated and DMF 29 January 2003).

From 1997-2001 the Buzzards Bay Project conducted a 319 project to demonstrate proactive land conservation is a viable tool for nitrogen management through the use of conservation restrictions, outright land purchase, and agricultural preservation restrictions. In Onset Bay 13-acres along the Agawam River were placed under conservation restriction protecting rare damselflies habitat, freshwater mussel beds, and a quaking sphagnum bog. Additionally, 4-acres were protected for wellfield protection areas (BBP 1997-2001).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in Onset Bay between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at seven stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Marks Cove, included in this segment, was sampled for nutrients at three stations (Howes *et al.* 1999). The average depth of Onset Bay 2 m but there is a dredged channel that is 16 m deep. There are some restrictions to herring migration and runoff from Cranberry Highway may be a significant source of pollution. In 1997 the Town of Wareham began improvements to mitigate 14 discharges in the Point Independence Area and a surface water management facility to treat storm water runoff. In 1997 and 1998 the Town extended the sewers to many neighborhoods in the Broad Cove and Muddy Cove. The Health Index Scores for Onset Bay have been in the good to excellent category with an average score for the past five years (1997-2001) of 80.3 (good to excellent). The Coalition also sampled Shell Point Bay, Muddy Cove, Broad Cove, and the East River "tributaries" to Onset Bay. Shell Point Bay received a Health Index Score of 65.3 (fair); Onset Bay Inner received a score of 73.9; and Onset Bay, East River received a Health Index Score of 59.5. Shell Point Bay and the East River water quality degradation appears to be the result of elevated nitrogen and chlorophyll *a* concentrations associated with tidal wetlands and bathymetric/flushing characteristics (CBB Undated b).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source G = ground | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|--------------------------------|---------|-------------------|-------------------------|----------------------------|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Onset Fire District, Wareham** | 4310003 | 9P42431001 | 42431031 | 4310003-03G 4310003-04G | Registered = 0.49 Permitted = 0.60 (1999 & 2000) Permitted = 0.62 (2001) | 0.6 | 0.57 | 0.57 |

*Excludes any authorized cranberry growers.

**Onset Fire District has four withdrawal points in the Buzzards Bay Basin – two in Segment MA95-01 and two in Segment MA95-02. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all four sources combined.

There are 162.792 acres of cranberry bog open space in the Onset Bay subwatershed (UMass Amherst 1999). For the purpose of this report, a conservative estimate of water use for this bog area is 1.45 MGD.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated wastewater discharges to this subwatershed. It should be noted, however, that Wareham is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

MA DEP identified the presence of eelgrass in Onset Bay from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Onset Bay were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 2002 aerial photography determined that the eelgrass bed identified in 1994 along the northwestern edge of the bay between Shell Point and the East River has declined (once continuous bed, now two smaller, segmented beds), the beds along the south/southwestern edge of the bay have declined (once continuous, now two separate smaller beds), the beds between Wicketts Island and Onset Island have declined, one bed between Onset Island and Sias Point has been lost, and the bed near the mouth of the bay appears to be stable/slightly declining.

Because of the loss/decline of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for Onset Bay. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include recreational activities (boating) and storm water.

SHELLFISH HARVESTING






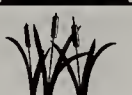
The DMF Shellfish Status Report of July 2000 indicates that areas BB40.0, BB40.21, BB40.22 are approved and BB40.20 and BB40.3 are conditionally approved (DFWELE 2000).

Based on the status of the shellfish growing areas in Onset Bay 0.63 mi² are assessed as support and 0.15 mi² are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

Based on the more stringent shellfish harvesting guidelines the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.63 mi². The remaining 0.15 mi² are currently not assessed.

Onset Bay (MA95-02) Use Summary Table

| Designated Uses | | Status | Causes | | Sources |
|----------------------|---|---|--|---|--|
| | | | Known | Suspected | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (loss/decline of eelgrass bed habitat) | Other anthropogenic substrate alterations, total nitrogen | Recreational activities (boat traffic), highway/road runoff, urbanized high density area, municipal separate storm sewer systems |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting |  | 0.63 mi ² SUPPORT 0.15 mi ² IMPAIRED | Fecal coliform bacteria | | Municipal separate storm sewer systems |
| Primary Contact |  | 0.63 mi ² SUPPORT 0.15 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 0.63 mi ² SUPPORT 0.15 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS ONEST BAY (MA95-02)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management program and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacterial inputs causing the closure of shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Implement the seven salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are WH30, WH31, WH05, WH06, WH07, WH08, and WH09. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data to assess the *Aquatic Life Use*.

BUTTERMILK BAY (SEGMENT MA95-01)

Location: Bourne/Wareham.

Segment Area: 0.67 square miles

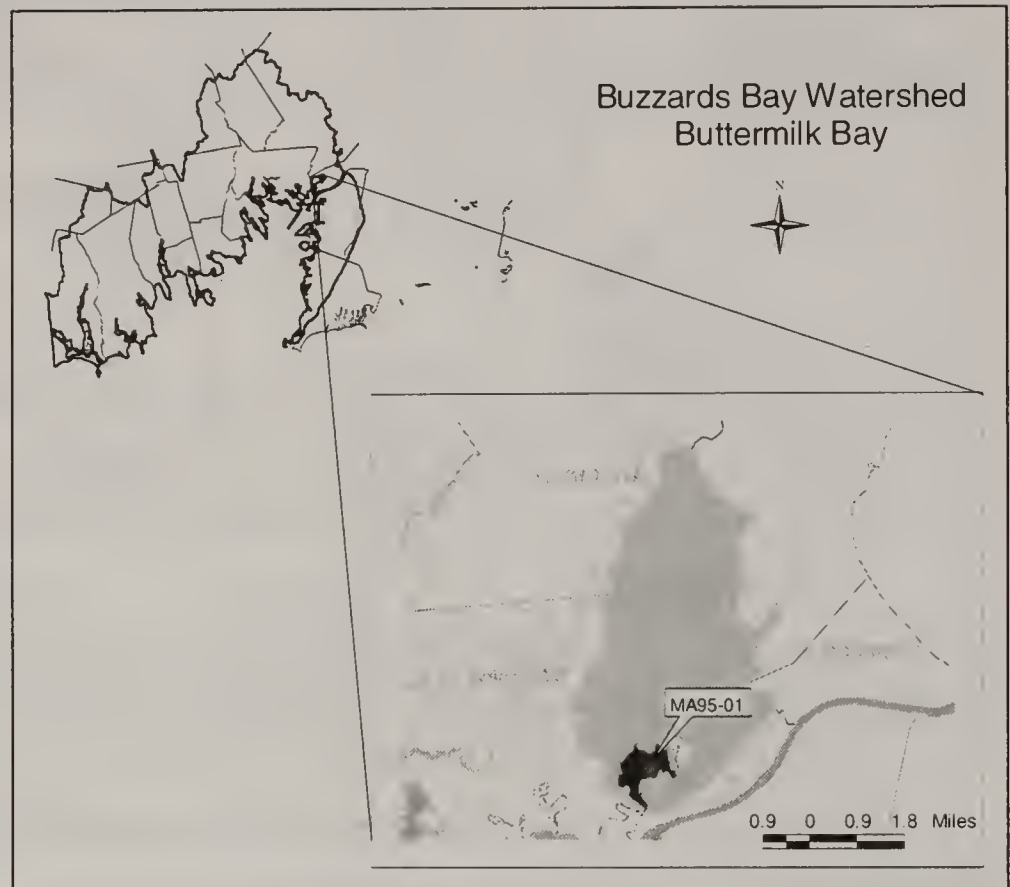
Classification: Class SA

The drainage area of this segment is approximately 15.7 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 57% |
| Residential | 20% |
| Open Land | 11% |

This segment is on the 1998 Massachusetts Section 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

The use assessments of Queen Sewell, Mare, and Sand ponds, which are located in the subwatershed of Buttermilk Bay, are provided in the Lakes Assessment section of this report.



There is a vessel sewage pump-out boat at Bevans/Continental Marina located on Cranberry Highway, Wareham (BBP Undated and DMF 29 January 2003).

In the Buttermilk Bay subwatershed the three towns of Bourne, Plymouth, and Wareham were the first to implement a holistic nitrogen management strategy based on growth management. In 1991 the three towns all adopted zoning changes to reduce the overall number of potential housing units that could be built in the watershed to ensure excess nutrients from future growth would not exceed what was believed at the time to be the critical nitrogen loading levels for the waterbody (Janik 2003).

The Army Corps of Engineers maintains a navigation channel in Buttermilk Bay that is 2,800-feet long, seven-feet deep and 100-feet wide. The ACOE dredges the natural channel of the bay that begins in the vicinity of Sears Point in Wareham and ends in an area between Taylor Point in Bourne and Peters Neck in Wareham. The original project was completed in 1953; in 1984, the channel was extended 2,500 feet to the site of a public marina. The extension is six feet deep and 80 feet wide (ACOE 1995).

The Coalition for Buzzards Bay conducted weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in this segment of Buttermilk Bay between May and September 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at five stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Little Buttermilk Bay, not part of this segment, was also sampled at one station. Little Buttermilk Bay, formerly a freshwater kettle pond, is now connected to Buttermilk Bay. Reduced tidal flushing is believed to contribute to the reduced water quality in Little Buttermilk Bay. Buttermilk Bay averages 1.5 m in depth (Howes *et al* 1999). The Health Index Scores from 1992-2001 for Buttermilk and Little Buttermilk bays have oscillated between fair and good/ excellent. The average Health Index Score for the past five years (1997-2001) for Little Buttermilk Bay is 62.8 (fair) and for Buttermilk Bay is 67.3 (good/excellent) with trends showing improvement. Elevated nitrogen and chlorophyll /pheophytin concentrations have been listed as the cause of water quality degradation. Remediation of 30 storm water discharges (see below) and sewerage are believed to be major factors in the improved water quality (CBB Undated b).

EPA documented in 1985 that Buttermilk Bay had elevated fecal coliform bacteria due to storm water runoff. Thirty storm drain systems discharged directly to Buttermilk Bay in 1985. Numerous storm drain remediation projects have occurred between 1990 and 2000 in the towns of Wareham and Bourne. Most notable was the installation in September 2000 of storm water infiltration structures at six high priority sites around the bay to remove fecal coliform bacteria, sediments, nutrients, fertilizers, hydrocarbons, metals, and organics. This construction was funded in 1996 through a 319 grant to the Buzzards Bay Project and the Town of Bourne (BBP 1996-2000).

The Massachusetts Division of Fisheries and Wildlife conducted fish population sampling in Red Brook, a tributary to Buttermilk Bay, on 6 June 1997 using backpack electroshocking equipment. Species collected, in order of decreasing abundance, included American eel (*Anguilla rostrata*), brook trout (*Salvelinus fontinalis*), golden shiner (*Notemigonus crysoleucas*), pumpkinseed (*Lepomis gibbosus*), river herring (*Alosa sp*), and one white perch (*Morone americana*). It was noted that trout were most abundant in the section above the last dam and that three trout (all in the same age class) had spinal deformities. DFW states that the survey "confirmed continued good reproduction of wild brook trout in Red Brook" (Hurley 2003).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source G = ground | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------------------------|---------|-------------------|-------------------------|--|--|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Atlantic Country Club, Plymouth | | 9P442423903 | | Well #1 Well #2 | Permitted = 0.13 | 0.11 | 0.06 | 0.12 |
| Buzzards Bay Water District, Bourne | 4036001 | 9P42403601 | 42403606 | 4036001-01G 4036001-02G 4036001-03G 4036001-04G | Registered = 0.37 Permitted = 0.11(1999 & 2000) Permitted = 0.14 (2001) | 0.52 | 0.47 | 0.48 |
| Plymouth Water Company, Plymouth | 4239045 | 9P442423905 | | 4239045-01G 4239045-02G | Permitted = 0.16 (1999 & 2000) Permitted = 0.22 (2001) | 0.14 | 0.14 | 0.23 |
| Onset Fire District, Wareham** | 4310003 | 9P42431001 | 42431031 | 4310003-01G 4310003-02G | Registered = 0.49 Permitted = 0.60 (1999 & 2000) Permitted = 0.62 (2001) | 0.6 | 0.57 | 0.57 |

*Excludes any authorized cranberry growers.

**Onset Fire District has four withdrawal points in the Buzzards Bay Watershed – two in Segment MA95-01 and two in Segment MA95-02. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all four sources combined.

There are 515.01 acres of cranberry bog open space in the Buttermilk Bay subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 4.60 MGD.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated discharges to this subwatershed, however, Bourne and Wareham are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass beds in Clarks Cove were mapped by MA DEP from field verified 1994 aerial photography along the northern shore and in Millers Cove and Queen Sewell Cove (Costello 2003). MA DEP field verified 2002 aerial photography revealed no eelgrass beds.

Because of the loss of eelgrass bed habitat the *Aquatic Life Use* is assessed as impaired for Buttermilk Bay. The eelgrass bed loss may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity. Suspected sources of nutrient enrichment include storm water, recreational activities (boating), and highway road runoff.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that area BB44.0 is approved; BB44.8 is conditionally approved; and areas BB44.3, BB44.4, BB44.5, and BB44.7 are prohibited (DFWELE 2000).







Based on the status of the shellfish growing areas in Buttermilk Bay 0.51 mi² are assessed as support and 0.16 mi² are assessed as impaired.

PRIMARY AND SECONDARY CONTACT RECREATION

According to the Barnstable County Health Department, there were no closures at the Electric Avenue Beach in 2001 (Dowden 2003).

Based on the more stringent shellfish harvesting guidelines the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.51 mi². The remaining 0.16 mi² are currently not assessed.

Buttermilk Bay (MA95-01) Use Summary Table

| Designated Uses | | Status | Causes | | Sources |
|-----------------------|---|---|--|---|--|
| | | | Known | Suspected | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (loss/decline of eelgrass bed habitat) | Other anthropogenic substrate alterations, total nitrogen | Recreational activities (boat traffic), highway/road runoff, urbanized high density area, municipal separate storm sewer systems |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | 0.51 mi ² SUPPORT 0.16 mi ² IMPAIRED | Fecal coliform bacteria | | Municipal separate storm sewer systems |
| Primary Contact |  | 0.51 mi ² SUPPORT 0.16 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 0.51 mi ² SUPPORT 0.16 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS BUTTERMILK BAY (MA95-01)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a bacteria monitoring plan to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacterial inputs to Buttermilk Bay causing shellfish bed closures. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, for improving effectiveness of fish ladders in this segment and increasing habitat. If applicable, review data for use in assessing the *Aquatic Life Use*.
- Implement the two salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are BN03, BN04, BN39, BN40, WH40, and WH41. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

CAPE COD CANAL (SEGMENT MA95-14)

Location: Connection between Buzzards Bay and Cape Cod Bay in Bourne and Sandwich

Segment Area: 1.13 square miles

Classification: Class SB,

Shellfishing (Restricted)

The drainage area of this segment is approximately 9.1 square miles. Much of the drainage area consists of a narrow strip of land that includes a vegetated buffer and service road on each side of the waterway.

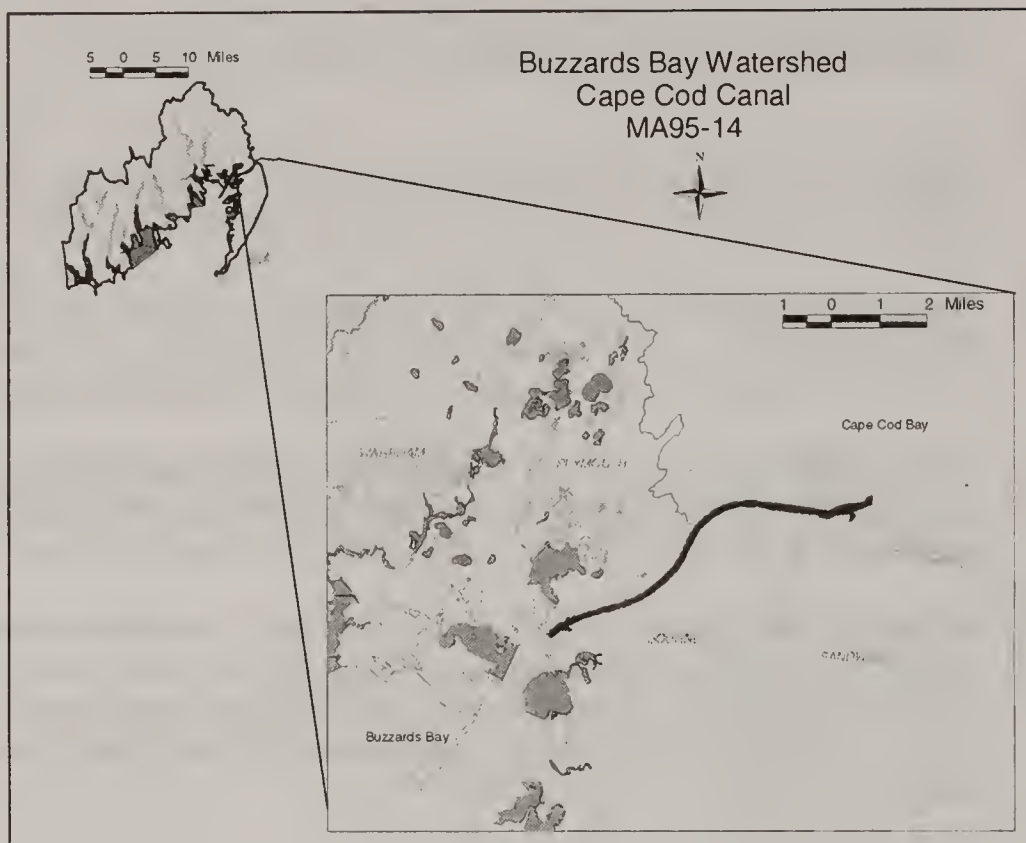
This segment is on the Massachusetts 1998 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

The Cape Cod Canal is 32 feet deep, 700 feet wide and extends 7.4 miles across the narrow neck that joined Cape Cod to the

mainland. Private interests sold the canal to the US in 1921 for \$11.5 million. The US Army Corps of Engineers (ACOE) was charged with operation and maintenance. In 1933 the Sagamore, Bourne, and railroad bridges were authorized and constructed. Additional information on the history of the Cape Cod Canal may be obtained in the ACOE (1995) *Massachusetts Water Resources Development- Flood Damage Reduction, Shore & Bank Protection, Navigation Report* publication NEDEP-360-1-34.

Four million visitors annually enjoy the canal and adjacent land for outdoor recreation including saltwater fishing, biking, and hiking (ACOE 31 January 2002). Scusset Beach is located on Cape Cod Bay at the east end of the Cape Cod Canal. It is a popular swimming and camping area. The 98-site camping area is very popular with trailer campers. For salt water anglers the area offers a popular fish pier, a 3000 breakwater and 1.5 miles of frontage along the canal. A picnic area and bicycling along the service roads is also available (MA DEM Undated d). There are two vessel sewage pump-out boats and a shoreside facility at the Bourne Marina located on Academy Drive, Bourne. Additionally, there is a pump-out facility at the Sandwich Marina on Moffitt Avenue, Sandwich. Both pump-out facilities were funded by the Clean Vessel Act and are available free of charge (DMF 29 January 2003). ACOE planned to dredge the Cape Cod Canal and the West Mooring Basin in early fall 2002 removing approximately 300,000 yds³ from shoal areas and placing it in the Cape Cod Canal Disposal Site or the Cleveland Ledge Disposal Site. Additionally two large boulders, one opposite Massachusetts Military Academy and one opposite Cleveland Ledge Light will be removed (ACOE 31 January 2002).

The National Marine Life Center in Bourne with support from EOEAs Wetlands Restoration Program has asked the ACOE to undertake a saltmarsh restoration project to re-establish tidal interaction to a degraded saltmarsh. The project seeks to modify an aging and undersized culvert to Cape Cod Canal. The Marine Life Center hopes that by restoring the saltmarsh and developing an open-water pond they will be able to rehabilitate recovering sea mammals (ACOE 31 January 2002).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------|--------|-------------------|-------------------------|--|-----------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Mirant Canal, LLC | | | 42226109 | Freezer Rd Well #1 Freezer Rd Well #2 | 0.45 | 0.47 | 0.45 | 0.5 |

NPDES SURFACE DISCHARGE SUMMARY

Mirant Canal, L.L.C. (formerly the Canal Electric Company) in Sandwich is permitted (MA0004928 issued 23 June 1989) to discharge the following stated maximum daily volumes via five outfalls to Cape Cod Canal.

Outfall 001: 518 MGD of condenser cooling water. Chlorine may be used as a biocide yet the Total Residual Chlorine allowed in the discharge is limited to a maximum concentration of 0.1 mg/l for no more than 2 hours per day. The temperature of the discharge is not to exceed 86° F in the upper water column.

Outfall 002: 4.4 MGD of intake screen sluice and flume flushing water. Water temperature at the mouth of the former discharge flume of Unit No. 1 is to be maintained at or below 90° F.

Outfall 010: 0.144 MGD of floor and equipment drains. Oil and grease discharged from this outfall may not exceed a maximum daily concentration of 15 mg/l.

Outfall 011: 0.4 MGD of waste system blowdown from the four waste ponds. The effluent may not exceed maximum daily concentrations of Total Copper (1.0 mg/l), Total Iron (1.0 mg/l),

Outfall 012: 0.12 MG (not to exceed 600 gpm) of demineralizer and condensate polisher waste. Maximum daily concentrations are stated for total suspended solids (100.0 mg/l) and oil and grease (15 mg/l).

A storm water runoff report was to be submitted. It requires regular monitoring at each storm water outfall within an hour after the start of a storm. No biological monitoring was required, however, the permittee should be providing notification of any incidence of fish mortality associated with the thermal plume or "unusual numbers of fish" impinged on the intake screens.

Massachusetts Maritime Academy (MA0024368) is permitted (20 April 2001) to discharge 0.14 MGD treated sanitary wastewater and untreated boiler water blow-down via outfall 001 and 10,000 GPD treated swimming pool discharge water via outfall 002 to the Cape Cod Canal. The facility's whole effluent toxicity limit is $LC_{50} \geq 50\%$ effluent.

Bourne and Sandwich are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their systems over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Toxicity

Effluent

Massachusetts Maritime Academy (MA0024368) conducted three whole effluent toxicity tests using the test organisms *M. bahia* and *M. beryllina* between June 2001 and June 2002. Acute toxicity was not detected (LC_{50} 's > 100% effluent).

Ambient

Between June 2001 and June 2002 Massachusetts Maritime Academy collected water from the Cape Cod Canal for use as dilution water in their whole effluent toxicity tests. Survival of *M. bahia* and *M. beryllina* (exposed 48-hours) was good (88-100%).

Too limited data are available, therefore, the *Aquatic Life Use* is not assessed.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB45.2 and BB45.3 are approved, and BB45.1, BB45.5, and BB45.4 (was restricted but recently changed) are prohibited (DFWELE 2000 and Whittaker 2003).







Based on the DMF shellfish status the *Shellfish Harvesting Use* is assessed as support for 0.49 mi² and impaired for 0.33 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

While swimming in the canal is not allowed there is a saltwater beach in Bourne Scenic Park Campground. According to the Barnstable County Department of Health records there was one elevated reading on July 11, 2001 the day after a rain event. The beach was resampled on July 12, 2001 and met water quality standards required under the Beach Bill (Dowden 2003).

Based on the more stringent shellfish harvesting guidelines the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.49 mi². The remaining 0.33 mi² are currently not assessed.

Cape Cod Canal (MA95-14) Use Summary Table

| Designated Uses | | Status | Causes | Sources |
|-----------------------|---|---|-------------------------|---------|
| | | | Known | Known |
| Aquatic Life |  | NOT ASSESSED | | |
| Fish Consumption |  | NOT ASSESSED | | |
| Shellfish Harvesting* |  | 0.67 mi ² SUPPORT 0.46 mi ² IMPAIRED | Fecal coliform bacteria | Unknown |
| Primary Contact |  | 0.67 mi ² SUPPORT 0.46 mi ² NOT ASSESSED | | |
| Secondary Contact |  | 0.67 mi ² SUPPORT 0.46 mi ² NOT ASSESSED | | |
| Aesthetics |  | NOT ASSESSED | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS CAPE COD CANAL (MA95-14)

- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce contaminants causing the closures of the shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Mirant Canal, L.L.C. discharges once through cooling water to Cape Cod Canal. Aquatic resources (fish, shellfish, etc.) within receiving waters may be susceptible to the impacts of the discharge. Additional monitoring should be implemented and results provided to the regulatory agencies to identify possible impacts. Mirant Canal LLC's NPDES discharge permit (MA0004928, issued 23 June 1989, expired 23 June 1994) should be reviewed and reissued with appropriate discharge limits and monitoring requirements.

In general, MA DEP recommends that all power plant operators in the Commonwealth collect the following types of information:

1. flow (cooling water use schematic, permit limits and location of intake(s) and discharge(s));
2. intake design (should include velocity across screens, mesh size, information as to the ability to rotate screens, mechanisms for removing impinged fish, fish return systems);
3. discharge (thermal limit, discharge structure design);
4. monitoring program (Discharge Monitoring Reports type and report frequency);
5. biological monitoring (description of any biological monitoring programs required by permit);
6. fish kill (description of any specific fish kill provisions included in permit);
7. hydrological monitoring; and
8. storm water management plan.

THE PHINNEYS HARBOR DRAINAGE AREA

The Phinneys Harbor Drainage Area in Bourne consists of the following three segments.

- Eel Pond (MA95-48)
- Back River (MA95-47)
- Phinneys Harbor (MA95-15)

EEL POND (SEGMENT MA95-48)

Location: Salt water pond that discharges to Back River, Bourne

Segment Area: 0.03 square miles

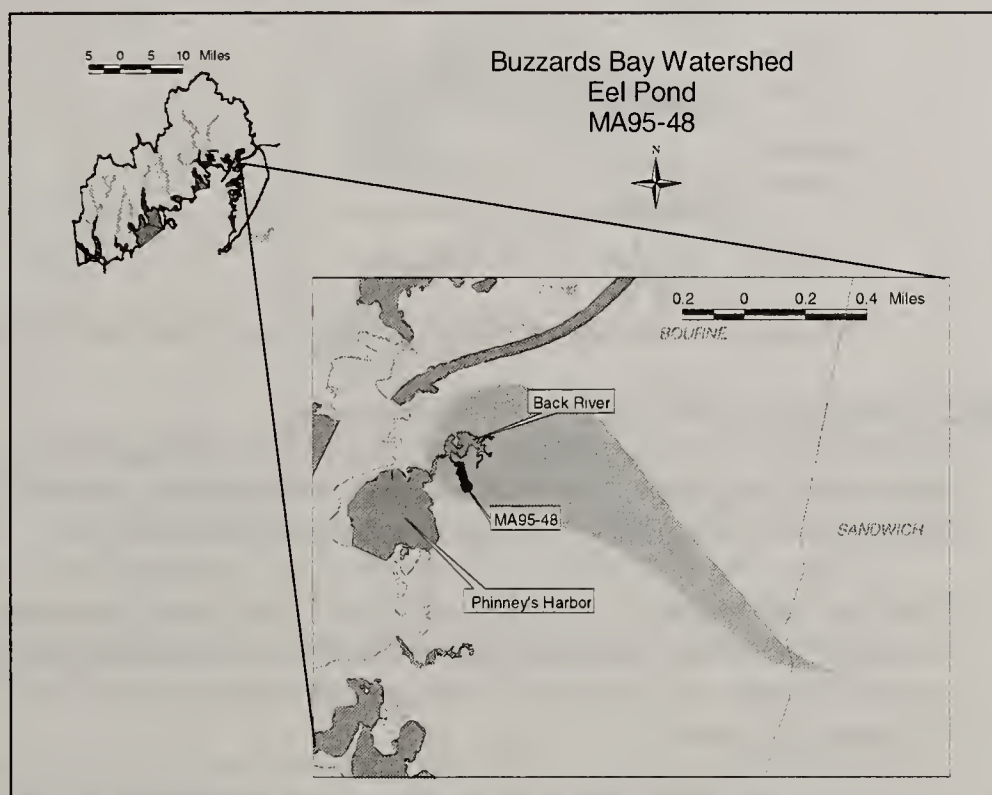
Classification: Class SA

A recharge area and, therefore, land use estimates, are not available for this segment.

Eel Pond is a salt water embayment that flows into Back River prior to discharging into Phinneys Harbor. It is shallow enough for some of the area to drain completely at low tide, leaving tidal flats (MA EOEa, 2003).

The Bourne Back River, including Eel Pond, was designated an Area of Critical Environmental Concern (ACEC) in 1989.

The Town has done storm water remediation work along Eel Pond (MA EOEa 2003).



The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in the Eel Pond between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al.* 1999). Chlorophyll *a* concentrations, phytoplankton blooms, and poor water transparency resulted in a Health Index Scores for Eel Pond (the average 1997-2001 score of 62.1 (fair) (CBB Undated b and Howes *et al.* 1999).

WMA WATER WITHDRAWAL (APPENDIX F) AND NPDES SURFACE DISCHARGE SUMMARY

There are no known regulated water withdrawals or discharges within this subwatershed. The Town of Bourne is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).







USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB47.2 is conditionally approved (DFWELE 2000).

Based on the DMF shellfish status the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

Eel Pond (MA95-48) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems, on-site treatment systems (septic systems) |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS EEL POND (MA95-48)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Develop and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, the Phase II community storm water management programs, and on-site septic system improvements and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce contaminant loadings that may result in the closure of the shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.

BACK RIVER (SEGMENT MA95-47)

Location: Outlet of small unnamed pond, downstream from Mill Pond, Bourne to confluence with Phinneys Harbor, Bourne (excluding Eel Pond)

Segment Area: 0.08 square miles

Classification: Class SA

Back River is shallow and some of its area drains completely at low tide, leaving tidal flats. The recharge area of this segment is approximately 3.7 square miles. Land-use estimates (top three, excluding water), including land use of Segment MA95-48, for the recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 55% |
| Open land | 17% |
| Residential | 17% |

The Bourne Back River was designated an Area of Critical Environmental Concern (ACEC) in 1989 and includes the Back River, Phinneys Harbor, Eel Pond, Clay Pond and Mill Pond. The Back River Estuary was designated an Estuary of National Significance by the US EPA in 1988 and is part of the Ocean Sanctuaries of Massachusetts. Most of the marshes, tidal flats, and freshwater wetlands within this area are undeveloped and serve as habitat to a large array of shellfish, finfish, amphibians, reptiles, birds, and mammals. The area contains at least three known state-listed rare and endangered species, including osprey, spotted turtle, and diamondback terrapin (MA EOEA 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Back River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Oxygen levels in Back River dropped below 60% saturation, however, due to the extensive wetland/saltmarsh in this watershed it is difficult to determine if these conditions are associated with anthropogenic sources or are natural conditions (Howes *et al.* 1999). The Back River 1997-2001 average Health Index Score was 66.8 (good/excellent) (CBB Undated b).

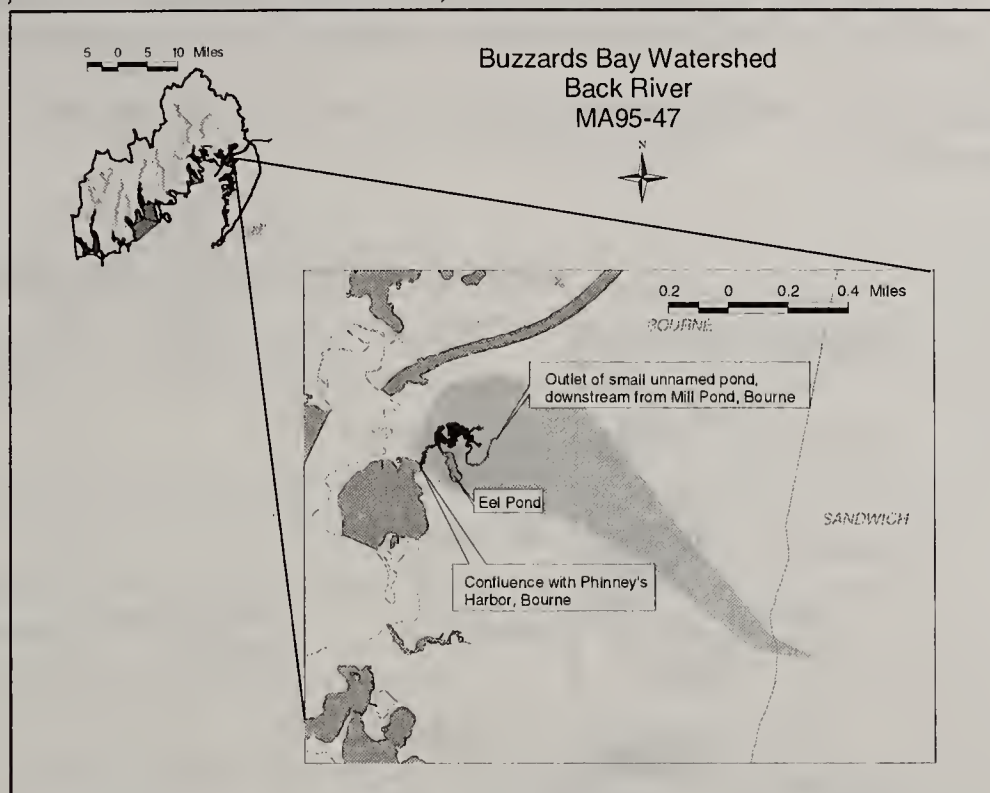
WMA WATER WITHDRAWAL

There are no known regulated water withdrawals within this subwatershed.

NPDES SURFACE DISCHARGE SUMMARY

The Lobster Trap Company is permitted (MA0029092, issued August 2, 1993) to discharge 7456 GPD treated wastewater from one outfall into the Back River. The permit includes the following secondary discharge limits: Total Suspended Solids = 30 mg/l, BOD = 30 mg/l and, fecal coliform concentrations not exceeding the water quality standards for SA waters (geometric mean of 14 colonies per 100 mL nor shall more than 10% of the samples exceed a MPN of 43/100 mL).

Bourne is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).









USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB47.1, BB47.2, and BB47.20 are conditionally approved and BB47.3 is prohibited (DFWELE 2000).

Based on the DMF shellfish status the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

Back River (MA95-47) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | Municipal separate storm sewer systems, on-site treatment systems (septic systems) |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS BACK RIVER (MA95-47)

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, to increase habitat. If applicable, review data for use in assessing the *Aquatic Life Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Develop and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce inputs of pathogens and possibly reopen shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.

PHINNEYS HARBOR (SEGMENT MA95-15)

Location: From the confluence with the Back River, to its mouth at Buzzards Bay between Mashnee and Tobys Islands, Bourne

Segment Area: 0.73 square miles

Classification: Class SA

A recharge area and, therefore, land use estimates are not available for this segment.

This segment is on the Massachusetts 1998 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

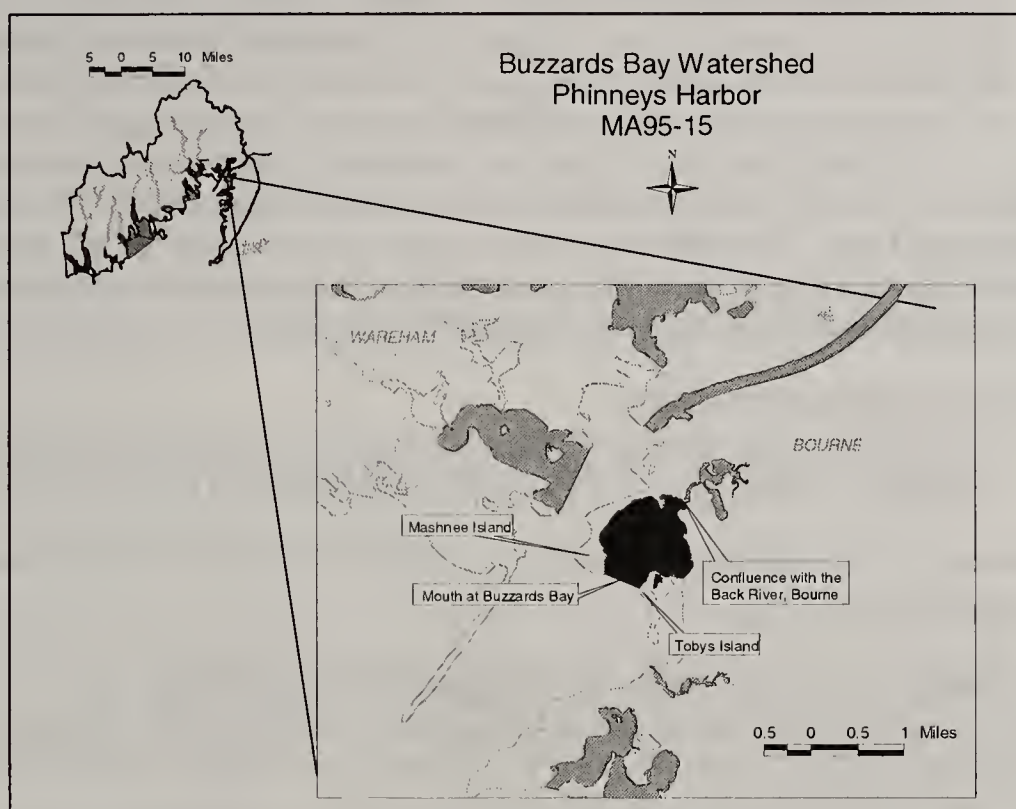
Phinneys Harbor is semi-enclosed due to the construction of a long dike out to Hog and Mashnee Islands, but was completely open to the bay at the beginning of the last century. The harbor has a mean depth of 2 meters with shallow marginal areas and a depth of 5 meters in the central portion of the harbor. Although eelgrass is present in the system there are reports of some die-offs (Howes *et al.* 1999). The Bourne Back River, including Phinneys Harbor, was designated an Area of Critical Environmental Concern (ACEC) in 1989. The Back River Estuary also was designated an Estuary of National Significance by the US EPA in 1988. Most of the marshes, tidal flats, and freshwater wetlands within this area are undeveloped and serve as habitat to a large array of shellfish, finfish, amphibians, reptiles, birds, and mammals. The area contains at least three known state-listed rare and endangered species, including osprey, spotted turtle, and diamondback terrapin (MA EOEA 2003).

The Gray Gables Salt Marsh has a severe tidal restriction prioritized in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts*. Five other sites in this subwatershed have been evaluated and prioritized by the Town. The Massachusetts Wetlands Restoration Program has accepted this as a restoration project with the goal of helping to prevent the shoaling that is presently occurring at the culvert's inlet. The project sponsor, Town of Bourne, may begin the planning stage by the end of 2002 or after Wings Neck wetland restoration project is completed (MA EOEA 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Phinneys Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at five stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* (Howes *et al.* 1999). The Phinneys Harbor 1997-2001 average Health Index Score was 73.0 (good/excellent) (CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY AND NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or NPDES discharges in this segment. Bourne is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).



USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Phinneys Harbor from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Phinneys Harbor were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 2002 aerial photography determined that the eelgrass beds identified in 1994 near Tobys Island had declined.

Although the *Aquatic Life Use* is not assessed, it is identified with an Alert Status due to the decline of eelgrass beds. Eelgrass dies off from reduced water clarity that may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources including substandard septic systems, recreational uses, or other anthropogenic activities.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB46.0 is approved and BB46.1 and BB47.20 are conditionally approved (DFWELE 2000).



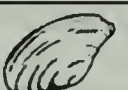

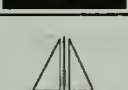
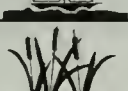
Based on the DMF shellfish status the *Shellfish Harvesting Use* is assessed as support for 0.58 mi² and impaired for 0.15 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

The village of Monument Beach has a public bathing beach. According to the Barnstable County Health Department there were no closures at Monument Beach in 2001 or 2002 (Barnstable County Department of Health 2003, Dowden 2003).

Based on the more stringent shellfish harvesting guidelines the *Primary* and *Secondary Contact Recreational Uses* are assessed as support for 0.58 mi². The remaining 0.15 mi² are currently not assessed.

Phinneys Harbor (MA95-15) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|---|-------------------------|---------|---|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | 0.58 mi ² SUPPORT 0.15 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | On-site treatment systems (septic systems), highway/road runoff |
| Primary Contact |  | 0.58 mi ² SUPPORT 0.15 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 0.58 mi ² SUPPORT 0.15 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

*Alert Status issues identified-- see details in use assessment section.

**For watershed-wide shellfish growing area data see Appendix E

RECOMMENDATIONS PHINNEYS HARBOR (MA95-15)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Develop and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce pollutant loadings to shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.
- Implement the six salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are BN9, BN10, BN29, BN30, BN11, and BN6. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Implement the recommendations from the Cape Cod Watershed Team Watershed Action Plan (EOEA 2003) including:
 - conduct Gray Gables Salt Marsh Restoration Project to restore eight acres, and
 - examine water quality impacts due to birds at Mashnee Island.

POCASSET RIVER (SEGMENT MA95-16)

Location: From the outlet of Mill Pond, Bourne to the mouth at Buzzards Bay, Bourne.

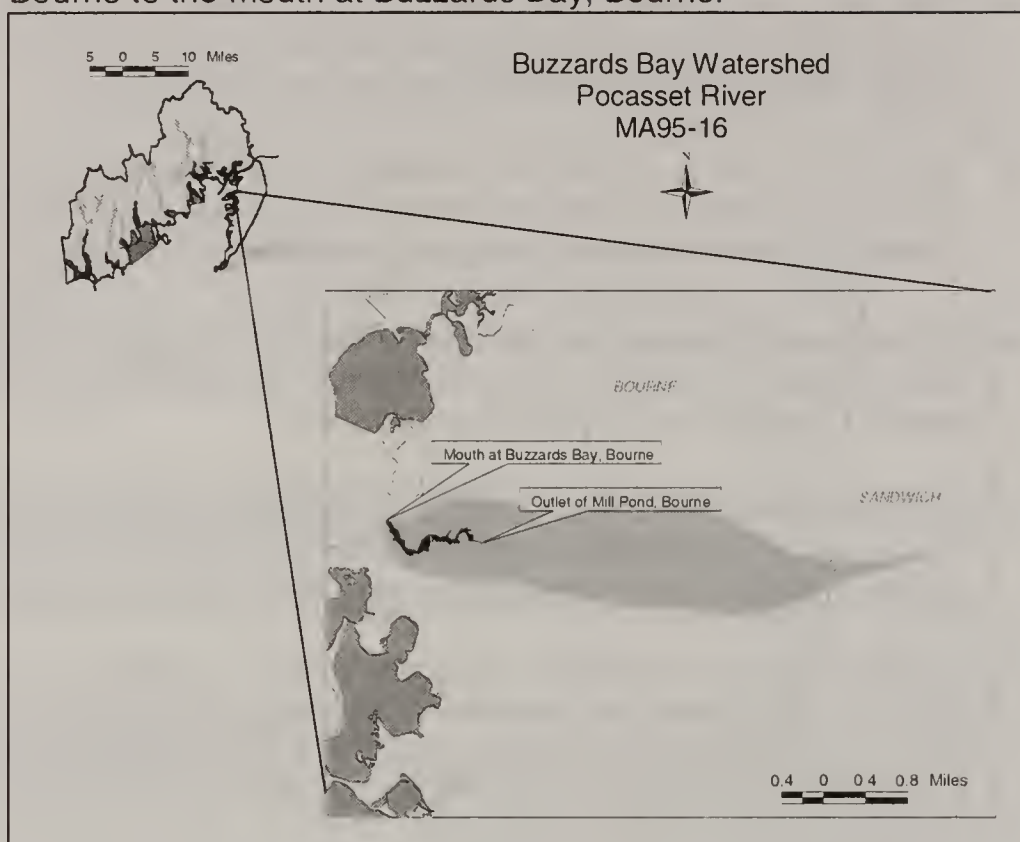
Segment Area: 0.05 square miles

Classification: Class SA,
Shellfishing (Open), ORW

The recharge area of this segment is approximately 3.3 square miles. Just over half of the land area is in the Mass. Military Reservation. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 65% |
| Residential | 18% |
| Open Land | 8% |

This segment is on the Massachusetts 1998 303(d) List of Waters, in the Cape Cod Watershed, as not meeting the water quality standards for pathogens (MA DEP 1999).



The Pocasset River, from the Shore Road Bridge to its headwaters, was designated an Area of Critical Environmental Concern (ACEC) in 1980. The relatively small river and estuarine system contains diverse resources ranging from the saltmarsh, tidal lands, and floodplains of the estuary to the connecting freshwater wetlands, ponds, and streams. The estuary supports the town's most productive oyster crop. A comprehensive ecological inventory of the lower portions of this system has been made (MA EOEA 2003). There is one public landing in the Pocasset River and approximately 190 moorings and slips. A public beach is located in Tahanto (MA EOEA 2003).

Two of the public water supply wells located in this subwatershed have been contaminated from a plume emanating from the central impact area of the MMR. In June 2001 the military funded a pipeline linking the Bourne Water District water main to the Upper Cape Water Supply Cooperative supply to make up for the projected drinking water shortfalls (MA EOEA 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in the Pocasset River between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Oxygen levels in Pocasset River dropped below 60% saturation. However, due to the extensive wetland/saltmarsh in this watershed it is difficult to determine if these conditions are associated with anthropogenic sources or are natural conditions (Howes *et al.* 1999). The Pocasset River 1997-2001 average Health Index Score was 67.7 (good/excellent) (CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)*

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-------------------------|---------|-------------------|-------------------------|---|---|--------------------------|-------|-------|
| | | | | | | 1999 | 2000 | 2001 |
| Bourne Water District** | 4036000 | 9P42203601 | 42203602 | 036-01G 036-03G 036-04G 036-06G*** | Registered =0.73 Permitted =0.64 (1999 & 2000) Permitted =0.67 (2001) | 0.884 | 0.815 | 0.913 |

*Excludes registered cranberry growers

**Bourne Water District has nine withdrawal points in the Buzzards Bay Watershed – four in Segment MA95-16 and five in Segment MA95-18. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all sources combined.

*** Well No. 6 (06G) requires monitoring of wetland as part of permit

NPDES SURFACE DISCHARGE SUMMARY

Bourne is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).







USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB48.0 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* for this segment is assessed as impaired for 0.04 mi².

Pocasset River (MA95-16) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|---|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | Unknown | On-site treatment systems, road runoff, municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS POCASSET RIVER (MA95-16)

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, and if necessary work to improve the effectiveness of fish ladders at Mill Pond, the headwaters of this segment. If applicable, review data to assess the *Aquatic Life Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a survey to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, septic system upgrades, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce pollutant loadings to shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Implement the four salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites in this subwatershed are BN28, BN33, BN14 and BN26. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Implement the recommendations of the Cape Cod Watershed Team Watershed Action Plan (MA EOE 2003) including:
 - determine the cause of the observed low oxygen conditions in Pocasset River,
 - maximize tidal exchanges between Pocasset River and Buzzards Bay through management to help maintain the water quality of the river system,
 - examine storm water discharge from Shore Road into Pocasset River. Develop BMP, and
 - examine remnant clay pipe south of Railroad Bridge.

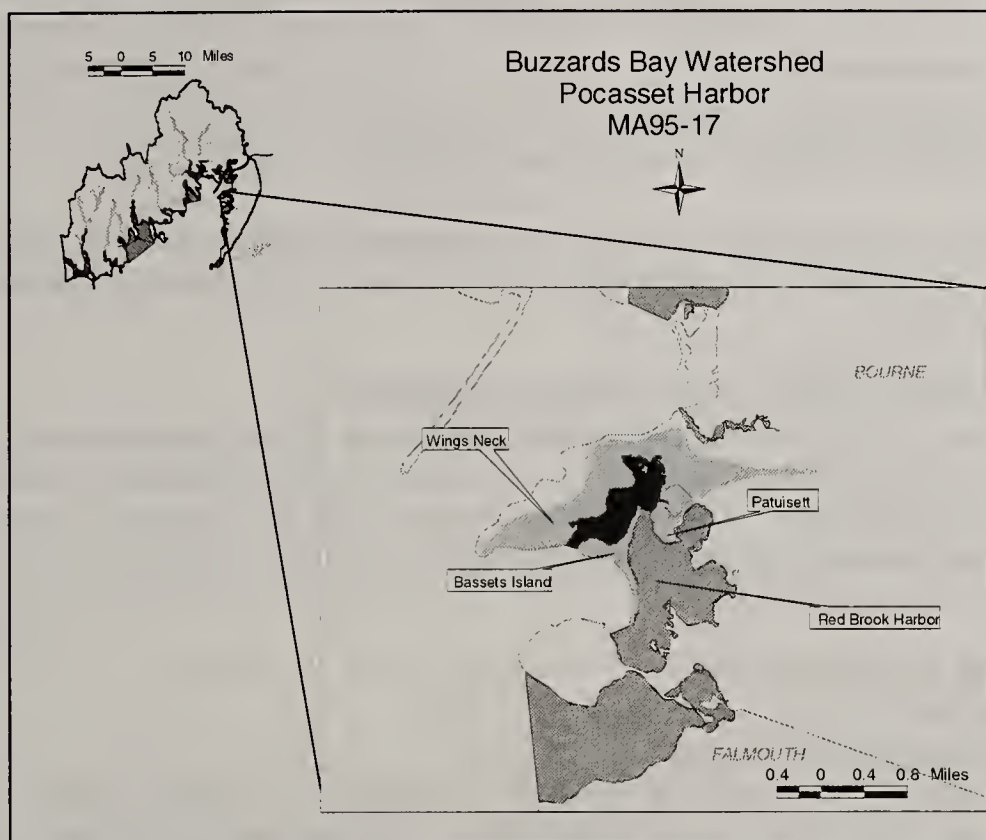
POCASSET HARBOR (SEGMENT MA95-17)

Location: From the confluence with Red Brook Harbor near the northern portion of Bassett's Island and Patuisset to the mouth at Buzzards Bay between Bassett's Island and Wings Neck, Bourne
Segment Area: 0.33 square miles
Classification: Class SA

The recharge area of this segment is approximately 1.2 square miles. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Residential | 41% |
| Forest | 35% |
| Open Land | 12% |

This segment is on the 1998 Massachusetts 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



Pocasset Harbor has shallow margins but maintains a two meter channel with depths of seven meters in the channel between Bassett's Island and Wings Neck. Most of the eelgrass is located in the shallower inner Harbor region and bordering the main deep channel to the mouth. The beds are moderate in coverage. Pocasset Harbor has been designated as nitrogen sensitive by the Cape Cod Commission, ranking 14 out of 52 embayments. The new Cape Cod jail will be located on the Massachusetts Military Reservation in this subwatershed. Construction will begin in 2002 and last 18 months. The facility will have a wastewater hookup to the Otis sewage treatment plant (MA EOEA 2003).

There is one public beach and boat landing and pier at Barlow's Landing. There are a total of about 1,245 moorings and slips and three public boat landings in the Pocasset Harbor system including Red Brook Harbor (see segment MA95-18) (MA EOEA 2003).

Two significant salt marsh restoration projects were recently completed or are underway, one in Barlows Landing, the other in Wings Neck. At Barlows Landing, the Town of Bourne, the Massachusetts Wetlands Restoration Program, and the US Fish and Wildlife Service partnered to restore 13 acres of salt marsh by replacing a 48" culvert with an 8' box culvert to restore tidal flow and alleviate ponding of water that caused marsh deterioration. Work was completed in 1998. By 2002 the funding for the Wings Neck Salt Marsh Restoration Project was in place from the same partners as well as private organizations and corporate donors. Tidal flow will be enhanced by replacing a 24" culvert with two 3'x4' culverts, restoring 8 acres of salt marsh (MA EOEA 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at three stations in Pocasset Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at six stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Significant improvement in water quality has occurred within the inner areas of Pocasset Harbor near Barlows Landing due to the implementation of storm water management practices (Howes *et al.* 1999). The average 1997-2001 Health Index Score for inner Pocasset Harbor was 68.6 and for outer Pocasset Harbor was 84.3 (good/excellent) (CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|----------------------|--------|-------------------|-------------------------|---------------------|-----------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Pocasset Golf Club** | | | 42203601 | Well #1 (G) | 0.09 | 0.12 | 0.06 | 0.12 |

* Excludes registered cranberry growers

**Indicates average withdrawal over less than 365 days

There are 3.635 acres of cranberry bog open space in the Pocasset Harbor water recharge area (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.03 MGD.

NPDES SURFACE DISCHARGE SUMMARY

There are no NPDES wastewater discharges to this subwatershed, however, Bourne is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Pocasset Harbor from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Pocasset Harbor were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 1999 aerial photography determined that eelgrass beds identified in 1951 had declined near Barlows Landing and Bassets Island. Between 1994 and 2002 the bed near Barlows landing had disappeared and additional decline had occurred near Bassets Island.

Because of the loss of eelgrass bed habitat near Barlows Landing and the decline of the remaining beds, the *Aquatic Life Use* is assessed as impaired for Pocasset Harbor. This loss may be attributed to recreational activities (i.e., boat traffic from landing and pier) and other anthropogenic activities that result in reduced water clarity and/or nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources including substandard septic systems and storm water runoff.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB49.0 is approved and BB49.20 and BB49.3 are conditionally approved (DFWELE 2000).







Based on the DMF shellfish growing area status the Shellfish Harvesting *Use* is assessed as support for 0.20 mi² and impaired for 0.13 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

According to the Barnstable County Health Department, there were no closures at Barlows Landing public beach in 2001 or 2002. (Barnstable County Department of Health 2003, Dowden 2003)

Based on the more stringent shellfish harvesting guidelines the *Primary and Secondary Contact Recreational Uses* are assessed as support for 0.20 mi². The remaining 0.13 mi² are currently not assessed.

Pocasset Harbor (MA95-17) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|----------------------|---|---|--|--|---------|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (loss/decline of eelgrass bed habitat) | Other anthropogenic substrate alterations (resuspension of sediment), total nitrogen | | Recreational activities (boat traffic), highway/ road runoff |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting |  | 0.20 mi ² SUPPORT 0.13 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | On-site treatment systems (septic systems), highway/ road runoff, municipal separate storm sewer systems |
| Primary Contact |  | 0.20 mi ² SUPPORT 0.13 NOT ASSESSED | | | | |
| Secondary Contact |  | 0.20 mi ² SUPPORT 0.13 mi ² NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

* For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS POCASSET HARBOR (MA95-17)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring so that the status of the *Aquatic Life Use* can be assessed.
- Design and conduct a survey to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, septic system improvements and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacterial inputs to Pocasset Harbor and possibly reopen shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.
- Towns, marinas, and harbormasters should encourage boat owners to make use of the pump-out facilities located in Red Brook Harbor to reduce bacterial inputs to Pocasset Harbor (Howes *et al.* 1999).
- Implement the recommendations from the EOEA Cape Cod Watershed Team Watershed Action Plan (MA EOEA 2003) including:
 - identify source of pollution into Wings Neck Creek and Barlows Landing.

RED BROOK HARBOR (SEGMENT MA95-18)

Location: From the confluence with Pocasset Harbor between the northern portion of Bassetts Island and Patuisset to its mouth at Buzzards Bay between Bassetts Island and Scraggy Neck, Bourne (including Hen Cove)

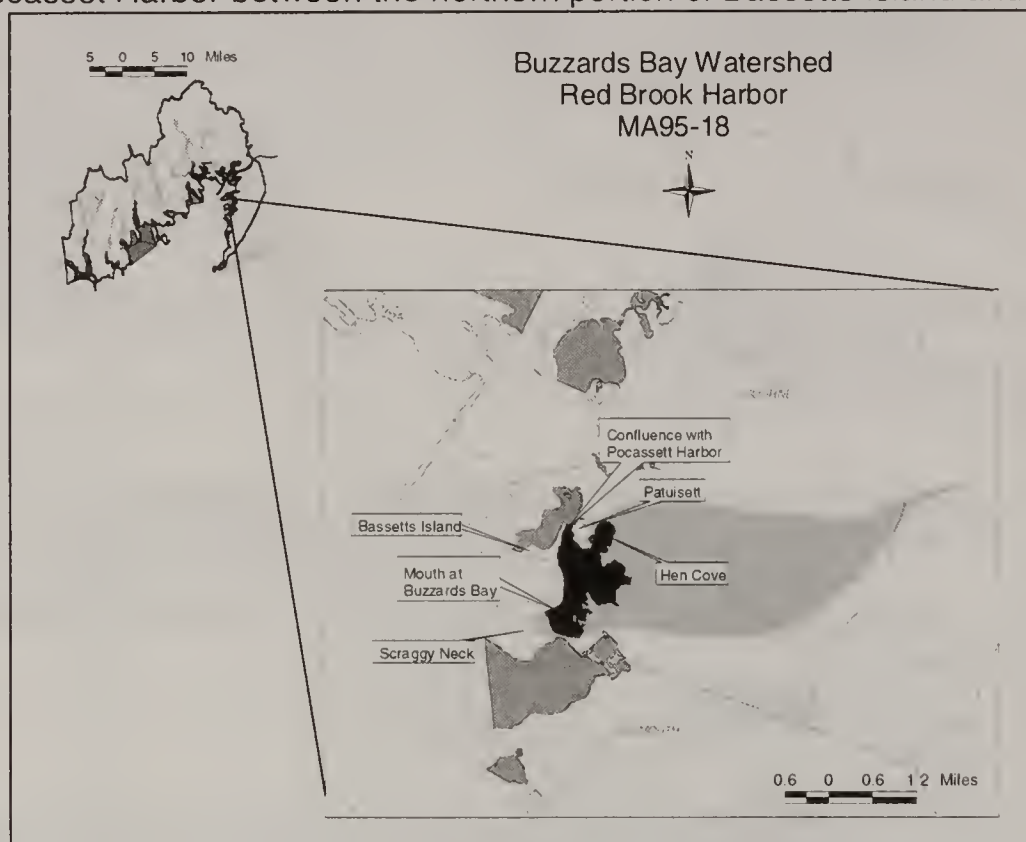
Segment Area: 0.91 square miles

Classification: Class SA

The recharge area of this segment is approximately 1.6 square miles. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 64% |
| Residential | 15% |
| Open Land | 12% |

This segment is on the Massachusetts 1998 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).



According to The Coalition of Buzzards Bay *Baywatchers II* report, Red Brook Harbor is one of the least developed watersheds in Buzzards Bay. The harbor itself has 14 acres of fringing salt marsh and has lost its eelgrass beds in recent years. Hen Cove has over 100 moorings and slips, a well used public beach, private beaches and a boat launch. There is a public beach in Hospital Cove (Merriam Beach). The harbor is heavily used for recreation with numerous slips and moorings and two marinas which both have pump-out facilities. The Red Brook Harbor subwatershed contains 92 acres of cranberry bogs (Howes *et al.* 1999). The new Cape Cod jail will be located on the Massachusetts Military Reservation in this subwatershed. Construction will begin in 2002 and last 18 months. The facility will have a wastewater hookup to the Otis sewage treatment plant (MA EOEA 2003).

The Cape Cod Commission included Red Brook Harbor in the Pocasset Harbor designation as nitrogen sensitive, ranked 14 out of 52 embayments. The Acid Rain Monitoring Project by the University of Massachusetts-Amherst (2001) studied Red Brook Pond. Samples are taken three times a year, in April, July, and October. The Acid Neutralizing Capacity of the pond was found to be in the "highly sensitive" range, meaning that the aquatic environment is highly sensitive to acid deposition (MA EOEA 2003).

A plume emanating from a former landfill (LF-1) on the MMR has contaminated 2 public water supply wells located in this drainage area and the northern of two lobes has reached the coast at Red Brook Harbor. The contaminants of concern include tetrachloroethene or perchloroethene (PCE), trichloroethene (TCE), and carbon tetrachloride. The public water supply wells were closed after traces of the chemical perchlorate, used in explosives, were found in both of them. The landfill has been capped and remediation efforts managed by the AFCEE have been underway since 1999 (AFCEE 2001). In June 2001 the military funded a pipeline linking the Bourne Water District water main to the Upper Cape Water Supply Cooperative supply to make up for the projected drinking water shortfalls (MA EOEA 2003). The AFCEE will continue monitoring at Red Brook and Squeteague Harbors.

Groundwater samples were collected along and beneath Red Brook Harbor by the U.S. Geological Survey in the summer of 2000 to investigate where freshwater discharges into the harbor and what concentrations of VOCs are present. TCE and PCE were detected from 68 to 176 feet below mean sea level at the Red Brook Harbor shoreline. The highest concentration (15 ppb of TCE) was detected at 176 feet below sea level. PCE was detected at less than 1 ppb. (The Federal and state maximum contaminant levels for drinking water is 5 ppb for both TCE and PCE.) TCE was also detected in several freshwater

locations (6 of 19 locations) beneath Red Brook Harbor, under the soft bottom sediments. Concentrations ranged from non-detect to 4.5 ppb at 500 feet from shore. The USGS concluded that even with TCE and PCE present in the groundwater just before it discharges to Red Brook Harbor it is unlikely that these compounds would be detected in the seawater due to dilution and tidal flushing. MDPH sampled shellfish from Red Brook Harbor in 1997. No VOCs were detected. In 2001 MDPH evaluated the risk associated with shellfish consumption based on the results of the 2000 USGS groundwater survey. They concluded that TCE bioconcentration in shellfish is unlikely to result in exposure levels that would present unusual health concerns (AFCEE 2001, MDPH 2002d).

The Red Brook Harbor/Pocasset Harbor/Hen Cove system was selected as a priority area for Year 2 of the Massachusetts Estuaries Project. The estuarine system will be evaluated in 2003.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Red Brook Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at four stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Occasional dissolved oxygen depletions indicate that this estuary is susceptible to hypoxia associated with warm temperatures, overcast and calm weather (Howes *et al.* 1999). The 1997-2001 Average Health Index Score for the inner Red Brook Harbor was 64.9 and the Outer Red Brook Harbor was 72.4 (both good/excellent) (CBB Undated b).

Two stations in Hen Cove (part of this segment) also are monitored by the Coalition for Buzzards Bay between May and September from 1992 to the present. A flushing study was conducted in Hen Cove in 1997. Fecal coliform bacteria contamination of the cove from the surface water inflow of a small fresh water pond is of concern. The Coalition states that eelgrass beds were present in the cove in 1985 but disappeared by 1996 (Howes *et al.* 1999). Residential development and on-site septic systems are cited as principle sources of nitrogen to Hen Cove. The 1997-2001 average Health Index Score for Hen Cove was 64.8 (good/excellent) (CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|-----------------------|---------|-------------------|-------------------------|---------------------|---|--------------------------|-------|-------|
| | | | | | | 1999 | 2000 | 2001 |
| Bourne Water District | 4036000 | 9P42203601 | 42203602 | 036-02G 036-05G | Registered= 0.73** Permitted= 0.64 (1999 & 2000) Permitted= 0.67** (2001) | 0.316 | 0.281 | 0.349 |

*Excludes registered cranberry growers

**Bourne Water District has nine withdrawal points in the Buzzards Bay Watershed – four in Segment MA95-16 and five in Segment MA95-18. The Authorized Withdrawal and Average Withdrawal volumes indicated are system wide for all sources combined.

There are 91.116 acres of cranberry bog open space in the Red Brook Harbor water recharge area (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.81 MGD.

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated NPDES wastewater discharges to this segment, however, Bourne is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

•

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of one small eelgrass bed in Red Brook Harbor along the western side of the harbor near Bassetts Island from historic 1951 black and white aerial photography (Costello 2003). Field surveys performed by MA DEP in 1998 and 2002 revealed no eelgrass in the entire harbor and the presence of macroalgae.

Although too limited data are currently available to assess the status of the *Aquatic Life Use*, this use is identified with an Alert Status because the USGS study (McCobb 2001) indicated that the northern lobe of the MMR landfill plume has entered the harbor. DMF has identified that flow manipulation associated with cranberry bog operations results in the loss of juvenile anadromous fish (Brady 2003). The loss of the eelgrass bed may also indicate a possible decline in water quality.

SHELLFISH HARVESTING

In September 1997 MDPH and DMF collected oysters, quahogs, soft-shell clams, and ribbed mussels from Red Brook Harbor. None of these samples had detections of VOCs associated with the Landfill #1 (LF-1) groundwater plume. MDPH planned to resample shellfish in the summer of 2001 at two sites at Red Brook Harbor and one in Squeteague Harbor in response to public concerns related to LF-1 plume contamination upwelling into the harbor in areas of shellfish beds (MDPH 2001b). They concluded that TCE bioconcentration in shellfish is unlikely to result in exposure levels that would present unusual health concerns (AFCEE 2001).

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB49.0 is approved, BB49.1 is conditionally approved, and BB49.5 is prohibited (DFWELE 2000).







Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for 0.80 mi² and impaired for 0.11 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

It should be noted that Patiusset Public Beach was closed infrequently during the 2001 and 2002 swimming season (8/1-2/2001, 8/22-24/2001, 6/7-10/2002 and 8/2-3/2002) based on elevated *Enterococci* bacteria levels (MDPH 2002d, Dowden 2003). However, this swimming area and the Mirriam Beach (no reported closures) are both located within the DMF's approved shellfishing area.

Based on the more stringent shellfish harvesting guidelines the *Primary and Secondary Contact Recreational Uses* are assessed as support for 0.80 mi². The remaining 0.11 mi² are currently not assessed.

Red Brook Harbor (MA95-18) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|---|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | 0.80 mi ² SUPPORT 0.11 mi ² IMPAIRED | Fecal coliform bacteria | Unknown | On-site treatment systems (septic systems), highway/ road runoff, municipal separate storm sewer systems |
| Primary Contact |  | 0.80 mi ² SUPPORT 0.11 mi ² NOT ASSESSED | | | |
| Secondary Contact |  | 0.80 mi ² SUPPORT 0.11 mi ² NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert Status issue identified-- see details in use assessment section.

** For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS RED BROOK HARBOR (MA95-18)

- DMF and the Cape Cod Cranberry Growers (CCCG) developed BMPs for the protection of juvenile anadromous fish (Brady 2003). DMF and CCCG should continue to work together to educate growers and develop operating practices that maintain baseflows for the protection of the aquatic life.
- Review and implement recommendations in the DMF anadromous fish assessment report, when available, and if necessary improve the effectiveness of fish ladders in Red Brook Pond to increase habitat. If applicable, review data when assessing the *Aquatic Life Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a survey to monitor bacteria levels in Red Brook Harbor to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, septic system upgrades, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce pollutant loadings to Red Brook Harbor. Continue to review DMF shellfish status reports to assess the *Aquatic Life Use*.
- Monitor the progress of the MMR landfill plume (LF-1) remediation and the USGS investigation of its effect on Red Brook Harbor. Review reports and data when assessing the *Aquatic Life Use*.
- Encourage boat owners to make use of the pump-out facilities in Red Brook Harbor.
- Implement the salt marsh restoration projects identified in the 2002 *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* that have been evaluated and prioritized by the Town. Sites include BN13, BN17, BN24, BN27, and BN21. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Implement the recommendations from the EOEA Cape Cod Watershed Team Watershed Action Plan (MA EOEA 2003) including:
 - implement BMP on storm drain off of Route 28 draining into Red Brook,
 - examine road runoff and flow from small pond at Island Drive for impacts to Hen Cove, and
 - conduct Hen Cove Salt Marsh Restoration Project.

THE MEGANSETT HARBOR DRAINAGE AREA

The Megansett Harbor Drainage Basin is located along the border of Bourne and Falmouth and consists of two segments, the inner and outer harbor, identified as:

- Squeteague Harbor (MA95-55), and
- Megansett Harbor (MA95-19).

SQUETEAGUE HARBOR (SEGMENT MA95-55)

Location: Bourne/Falmouth to confluence with Megansett Harbor

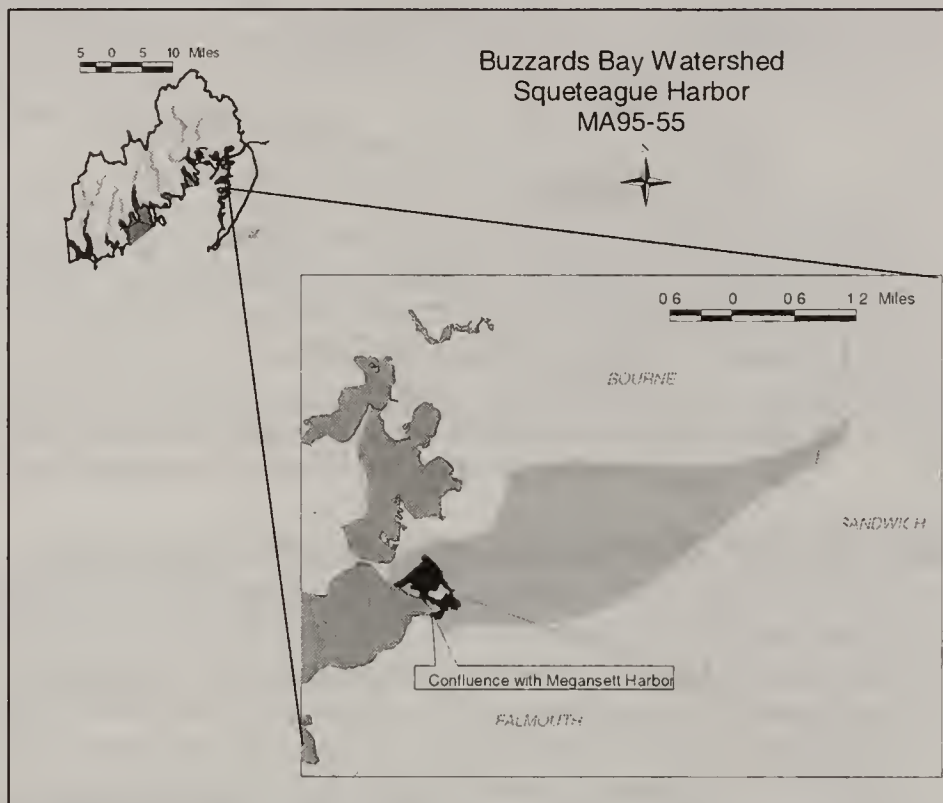
Segment Area: 0.15 square miles

Classification: Class SA

The recharge area of this segment is approximately 3.8 square miles. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 63% |
| Residential | 15% |
| Open Land | 13% |

The northern portion of the Squeteague Harbor drainage area falls within the Massachusetts Military Reservation. Past oil, fuel, chemical, and hazardous waste disposal activities have created a ground water pollution plume in this subwatershed. The southern lobe of LF-1 will likely be a consideration in future years. The Air Force Center For Environmental Excellence is investigating and addressing this groundwater pollution (MA EOE 2003).



The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Squeteague Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Eelgrass beds in Squeteague Harbor have diminished. Squeteague Harbor is showing water quality degradation related to nutrient impacts (elevated total nitrogen, chlorophyll *a* concentrations and periodic oxygen depletion). The tidal flushing of Squeteague Harbor is reduced due to the deposition of a barrier spit from erosion and long-shore transport and sedimentation of the inlet. Sources of nitrogen identified by the Coalition include on-site septic systems, storm water, and groundwater from MMR (Howes *et al.* 1999). Squeteague Harbor received an average 1997-2001 Health Index Score of 57.3 (fair) (CBB Undated b and Howes *et al.* 1999).

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or wastewater discharges in this subwatershed. It should be noted, however, that Bourne and Falmouth are Phase II communities and have submitted their notices of intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their systems over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of one eelgrass bed in Squeteague Harbor northwest of Amrita Island from historic 1951 black and white aerial photography (Costello 2003). A field survey performed by MA DEP in 1998 revealed the presence of macroalgae and no eelgrass in the entire harbor.

Although eelgrass bed habitat data are available there is low confidence in the 1951 data (Costello 2003), therefore, the *Aquatic Life Use* is currently not assessed. This use is identified, however, with an Alert Status as macroalgae may indicate a possible decline in water quality due to nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources or other anthropogenic activities that result in reduced water clarity.

SHELLFISH HARVESTING







The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB50.0 is approved (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for this entire segment.

PRIMARY AND SECONDARY CONTACT RECREATION

Based on the more stringent shellfish harvesting guidelines, the *Primary* and *Secondary Contact Recreational uses* are assessed as support.

Squeteague Harbor (MA95-55) Use Summary Table

| Aquatic Life* | Fish Consumption | Shellfish Harvesting** | Primary Contact | Secondary Contact | Aesthetics |
|---|---|---|--|---|---|
|  |  |  |  |  |  |
| NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | SUPPORT | NOT ASSESSED |

* Alert Status Issues identified—see details in use assessment section.

** For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS SQUETEAGUE HARBOR (MA95-55)

- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.
- Design and conduct a survey to monitor bacteria levels in Squeteague Harbor to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, septic system improvements, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce pollutants causing the closure of the shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Monitor the progress of the MMR landfill plume (LF-1) remediation and the USGS investigation of its effect on Squeteague Harbor, particularly as it pertains to the aquatic life.

- Implement the recommendations from the EOECA Cape Cod Watershed Team Watershed Action Plan (MA EOECA 2003) including:
 - examine measures to discourage waterfowl around Squeteague Harbor or address bacteria and nitrogen impacts from waterfowl and consider DNA testing of the water to determine if waterfowl are a source of bacteria.

MEGANSETT HARBOR (SEGMENT MA95-19)

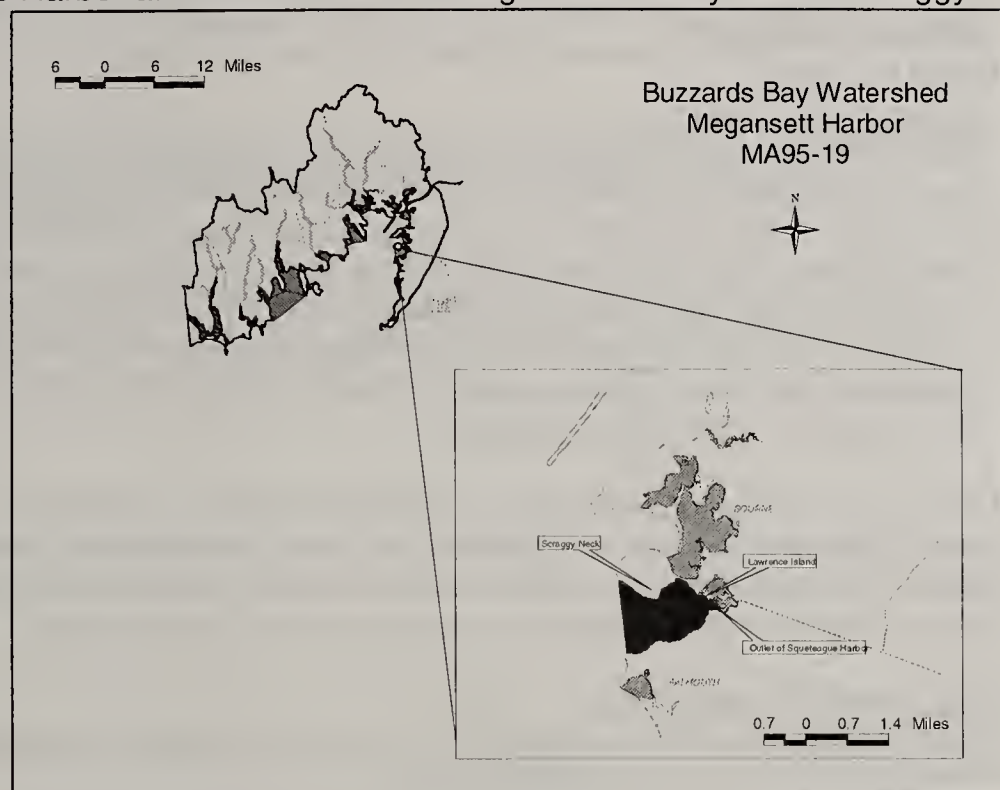
Location: From the outlet of Squeteague Harbor at Lawrence Island along the southerly side of Scraggy Neck, Bourne. The waters extend into Falmouth.

Segment Area: 1.26 square miles

Classification: Class SA

A recharge area and, therefore, land use estimates are not available for this segment.

There are only about 100 acres in this subwatershed that have not been developed but are available for development. Conversion of seasonal residences to year-round is a greater threat than new development (MA EOE 2003). There is a vessel sewage pump-out boat and shoreside facility in the nearby Brewer's Fiddler Cove Marina on Fiddler's Cove Road, Falmouth (BBP Undated and DMF 29 January 2003)



Megansett Harbor is a large, well-flushed outer basin compared to the much smaller, shallower inner basin of Squeteague Harbor. A flushing study published in 1999 showed that large portions of the harbor exchange water freely with Buzzards Bay (less than 1 day flushing rate), but the more remote regions take longer (over 100 days) to exchange water with the Bay (Jachec and Hamilton 1999). The remote embayments do flush rapidly, however, with their adjacent water body. According to the Coalition for Buzzards Bay *Baywatchers II* report these basins are important recreational harbors with about 150 moorings and 75 slips. The system also has several beaches and a public boat ramp and pier (Howes *et al.* 1999).

Dr. Jefferson Turner, students, and research associates at UMass Dartmouth have conducted 141 monthly cruises of Buzzards Bay between October 1987 and October 1998 to establish temporal and spatial trends of hydrography, water quality, and plankton community structure. Station 3 in Megansett Harbor was sampled for conductivity, temperature, depth, Secchi disk depth, salinity, nutrients, chlorophyll *a* and phytoplankton. Salinity was "almost uniformly 30 ppt throughout the study at virtually all times". Mean surface temperatures at station 3 met SWQS. Secchi disk depths at station 3 ranged from 2 to 8.4 m. Mean chlorophyll *a* concentrations at station 3 ranged between 0 µg/L and 17 µg/L. Mean ammonium concentrations ranged between 0 µM and 12 µM. Mean phosphate concentrations ranged between 0 µM and 2 µM (Turner *et al.* 2000).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in Megansett Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at four stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Water quality in Megansett Harbor was among the best of those embayments monitored and is maintained by low watershed loadings and the deep open basin (Howes *et al.* 1999). Megansett Harbor received an average 1997-2001 Health Index Score of 81.0 (good/excellent) (CBB Undated b).

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or NPDES wastewater discharges in this subwatershed. It should be noted, however, that Bourne and Falmouth are Phase II communities and have submitted their Notices Of Intent for permit coverage for their NPDES Municipal (MS4) drainage systems. Their

coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their systems over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Megansett Harbor from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Megansett Harbor were mapped by MA DEP from field verified 1994 aerial photography eelgrass bed habitat near Eustis Beach and Sunrise Beach had declined. MA DEP field verified 2002 aerial photography determined that the eelgrass beds identified in the 1994 mapping along the southern portion of the harbor near Fiddlers Cove had declined, however, the beds along the northern portion of the harbor near Scraggy Neck appeared stable and two new beds appeared in the northeastern quadrant of the harbor near Eustis Beach and the Lawrence Island (Costello 2003).

Although the *Aquatic Life Use* is not assessed for Megansett Harbor, this use is identified with an Alert Status. Eelgrass bed loss is of concern and may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources including substandard septic systems, recreational uses, or other anthropogenic activities that result in reduced water clarity.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing areas BB50.0 and BB50.20 are approved (DFWELE 2000).







Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for this entire segment.

PRIMARY AND SECONDARY CONTACT RECREATION

According to the Barnstable County Health Department there were no closures at the Megansett Beach in 2001 or 2002 (Barnstable County Department of Health 2003 and Dowden, 2003).

Based on the more stringent shellfish harvesting guidelines the *Primary and Secondary Contact Recreational Uses* are assessed as support.

Megansett Harbor (MA95-19) Use Summary Table

| Aquatic Life* | Fish Consumption | Shellfish Harvesting | Primary Contact | Secondary Contact | Aesthetics |
|---|---|---|--|---|---|
|  |  |  |  |  |  |
| NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | SUPPORT | NOT ASSESSED |

* Alert Status issues identified see details in use assessment section.

** For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS MEGANSETT HARBOR (MA95-19)

- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacteria loadings to Megansett Harbor and possibly reopen shellfish beds. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when assessing the *Aquatic Life Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.

WILD HARBOR (SEGMENT MA95-20)

Location: Falmouth

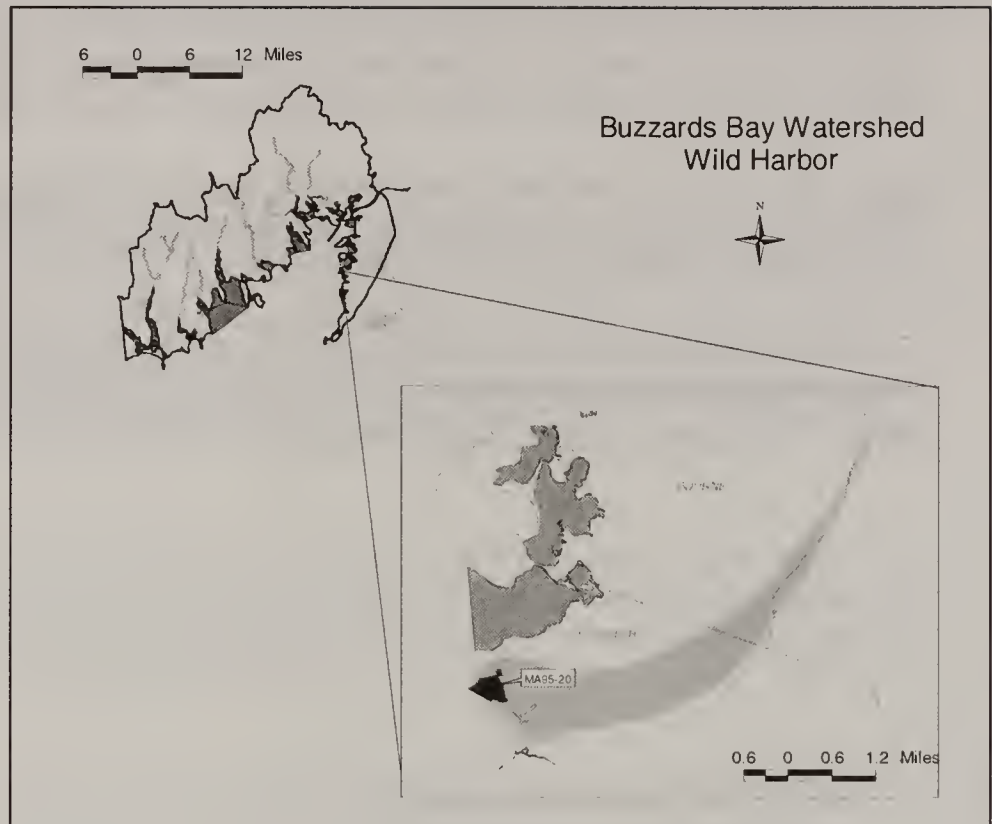
Segment Area: 0.14 square miles

Classification: Class SA

The recharge area of this segment is approximately 4.036 square miles. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 48% |
| Residential | 27% |
| Open Land | 19% |

Wild Harbor is a well-flushed embayment with salt marsh ringing the edges and a predominantly sandy bottom in the outer regions. New Silver Beach is a popular public beach and there are 98 boat moorings and slips in the Harbor (MA EOEA 2003). The upper end of the subwatershed is largely undeveloped because 39% of the land area is preserved in either Massachusetts Military Reservation or Crane's Wildlife Management Area. The lower section of the watershed, below Route 28, is near buildout and the trend is to convert seasonal cottages to year round homes (Howes *et al* 1999).



Only about five percent of the Town of Falmouth is publicly sewered. The sewered areas are Main Street in Falmouth and nearly all of Woods Hole. Ninety to ninety-five percent of the town is on municipal water. There is one treatment plant in Falmouth, currently processing 0.5 MGD with a capacity of 0.81 MGD. A \$14 million upgrade has been approved to bring the capacity up to 1 MGD in the next few years. This plant discharges to groundwater in the West Falmouth Harbor subwatershed (Segment MA95-22). In August 2001 the Town of Falmouth Department of Public Works submitted an ENF (August 2001) for a wastewater treatment plant that would serve the New Silver Beach area (two hundred new connections). The objective is to eliminate substandard individual onsite septic systems. The new collection system will gather and transmit wastewater to a new treatment facility located on Williams Road near the North Falmouth Elementary School that will discharge into the groundwater (MA EOEA 2003). Construction of this facility began in August 2003.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Wild Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at one station at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a* beginning in 1999. The harbor continues to support eelgrass beds with distribution limited by the water depth. Nitrogen loadings are associated with residential and commercial land uses including on-site septic system failures (Howes *et al.* 1999). The average 1997-2001 Health Index Score for Wild Harbor was 54.8 (fair) (CBB Undated b).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX F)

There are 23.511 acres of cranberry bog open space in the Wild Harbor subwatershed (UMass Amherst 1999). For the purpose of this report a conservative estimate of water use for this bog area is 0.21 MGD.

NPDES SURFACE DISCHARGE SUMMARY

There are no known surface NPDES discharges to Wild Harbor, however, Falmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water

management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

AQUATIC LIFE

Eelgrass Bed Habitat

MA DEP identified the presence of eelgrass in Wild Harbor from historic 1951 black and white aerial photography (Costello 2003). Eelgrass beds in Wild Harbor were mapped by MA DEP from field verified 1994 aerial photography. MA DEP field verified 2002 aerial photography determined that the eelgrass bed identified in 1994 had declined near the eastern inner shore in the vicinity of Silver Beach and Nye's Neck (Costello 2003).







Although the *Aquatic Life Use* is not assessed for Wild Harbor, this use is identified with an Alert Status. Eelgrass bed loss is of concern and may be associated with nutrient enrichment (i.e., elevated nitrogen loadings) from nonpoint sources including substandard septic systems, recreational uses or other anthropogenic activities that result in reduced water clarity, and the residual affects of the 1969 oil spill.

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that both shellfish growing areas (BB52.0 and BB52.2) are prohibited (area BB52.0 was approved in 2000 but was recently changed to prohibited) (DFWELE 2000 and Whittaker 2003).

Based on the DMF shellfish status the *Shellfish Harvesting Use* is assessed as impaired for this entire segment (0.14 mi²). In 1969 a barge spilled 180,000 gallons of no. 2 fuel oil that washed into Wild Harbor. According to the EOECA Cape Cod Watershed Action Plan most of the effects of this spill have long since dissipated but since it is still detectable in the substrate in places it still affects the shellfish.

Wild Harbor (MA95-20) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|------------------------|---|--------------|-------------------------|---------|---|
| | | | Known | Known | Suspected |
| Aquatic Life* |  | NOT ASSESSED | | | |
| Fish Consumption |  | NOT ASSESSED | | | |
| Shellfish Harvesting** |  | IMPAIRED | Fecal coliform bacteria | Unknown | On-site treatment systems (septic systems), other spill related impact (oil), highway/road runoff |
| Primary Contact |  | NOT ASSESSED | | | |
| Secondary Contact |  | NOT ASSESSED | | | |
| Aesthetics |  | NOT ASSESSED | | | |

* Alert Status issues identified-- see details in use assessment section

**For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS WILD HARBOR (MA95-20)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a survey to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewerage, and the Phase II community storm water management programs and assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacteria loadings to Wild Harbor. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.
- Implement the salt marsh restoration projects identified in the *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* (2002) that have been evaluated and prioritized by the Town. Sites in this subwatershed are FA11, FA12, FA13, FA35, FA36, FA37, and FA39. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

HERRING BROOK (SEGMENT MA95-21)

Location: From its headwaters, northeast of Dale Drive and west of Route 28A, to its mouth at Buzzards Bay, Falmouth

Segment Area: 0.01 square miles

Classification: Class SA

A recharge area and, therefore, land use estimates are not available for this segment.

This segment is on the Massachusetts 1998 303(d) List of Waters, in the Cape Cod Watershed, as not meeting the water quality standards for pathogens (MA DEP 1999).

WMA WATER WITHDRAWAL AND NPDES SURFACE DISCHARGE SUMMARY

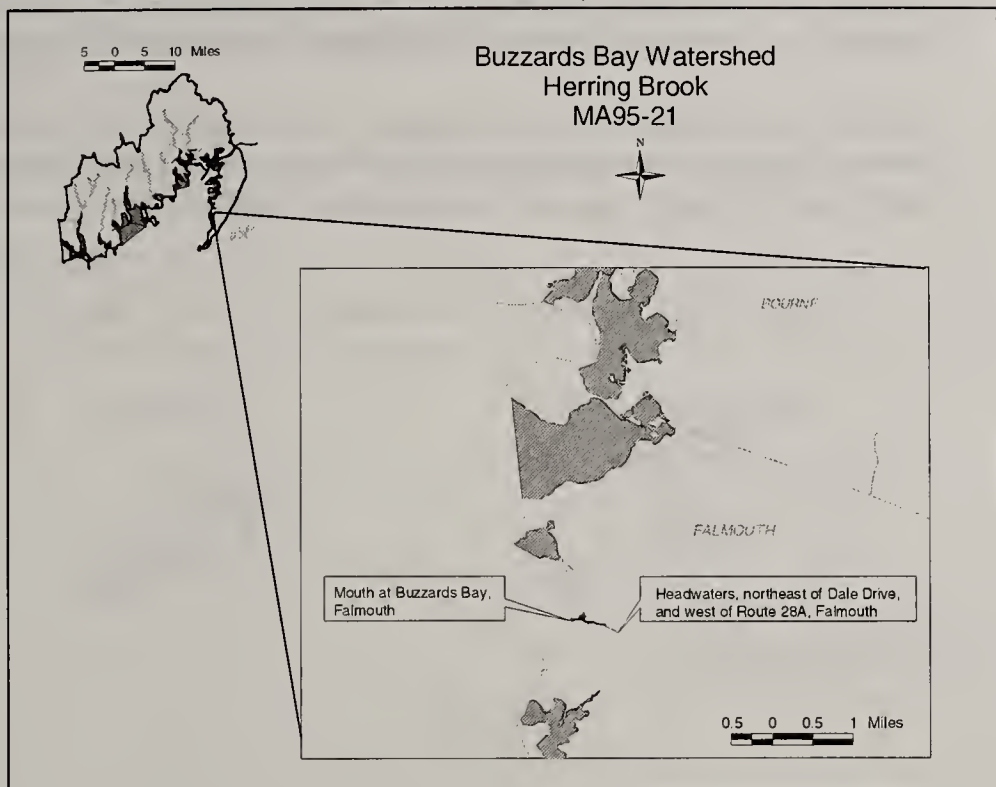
There are no regulated water withdrawals or NPDES surface discharges in this subwatershed. It should be noted, however, that Falmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB53.0 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* for this entire segment is assessed as impaired.



Herring Brook (MA95-21) Use Summary Table

| Designated Uses | | Status | Causes | Sources | |
|-----------------------|--|--------------|-------------------------|---------|--|
| | | | Known | Known | Suspected |
| Aquatic Life | | NOT ASSESSED | | | |
| Fish Consumption | | NOT ASSESSED | | | |
| Shellfish Harvesting* | | IMPAIRED | Fecal coliform bacteria | Unknown | On-site treatment systems (septic systems) |
| Primary Contact | | NOT ASSESSED | | | |
| Secondary Contact | | NOT ASSESSED | | | |
| Aesthetics | | NOT ASSESSED | | | |

* For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS HERRING BROOK (MA95-21)

- Review and implement recommendations in the DMF anadromous fish assessment report, when available, to increase habitat. If applicable, review data for assessing the *Aquatic Life Use*.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to remediate sources of bacteria causing shellfish bed closures. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.

WEST FALMOUTH HARBOR DRAINAGE AREA

The West Falmouth Harbor Drainage Area in Falmouth consists of two segments:

- West Falmouth Harbor (MA95-22)
- Harbor Head (MA95-46)

HARBOR HEAD (SEGMENT MA95-46)

Location: The semi-enclosed body of water south of the confluence with West Falmouth Harbor at Chappaquoit Road, Falmouth

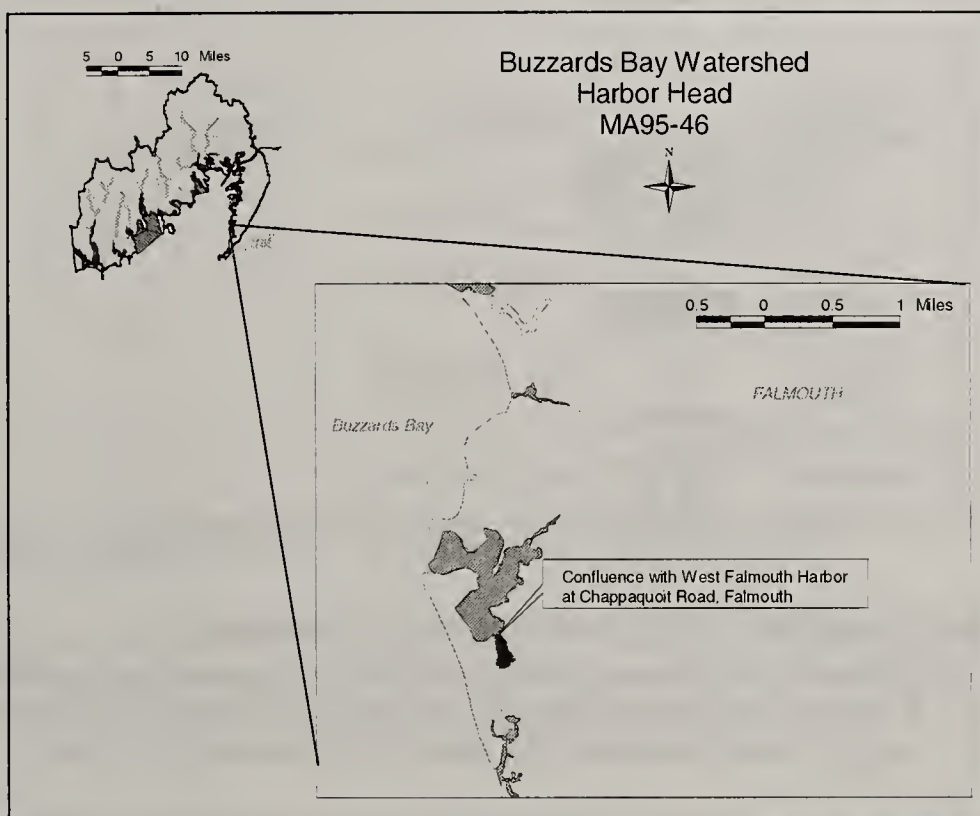
Segment Area: 0.02 square miles

Classification: Class SA

The West Falmouth Harbor recharge area includes this segment (see MA95-22).

This segment is on the Massachusetts 1998 303(d) List of Waters, a part of the formerly defined segment MA95-22 (West Falmouth Harbor), as not meeting the water quality standards for pathogens (MA DEP 1999). As part of the Estuaries Project a nutrient TMDL will be developed by SMAST in the next few years for West Falmouth Harbor system, which includes this segment.

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Harbor Head between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted by the Falmouth Pond Watchers at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Eelgrass communities are present in the Harbor, although it appears that some decline occurred within the inner areas. Nitrogen sources identified by the Coalition include the WWTF, storm water from road runoff and residential development, and the nitrogen enriched groundwater plume from the Falmouth Landfill and its former septage lagoons. Oxygen depletion (defined by CBB as <60% saturation) within the inner regions of the harbor is common and nitrogen levels are consistently higher and appear to coincide with the WWTF plume (Howes *et al.* 1999). The average 1997-2001 Health Index score for Harbor Head was 76.5 (good/excellent)(CBB Undated b).



WMA WATER WITHDRAWAL AND SURFACE NPDES DISCHARGE SUMMARY

There are no regulated water withdrawals or wastewater discharges in this segment. It should be noted, however, that Falmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).







USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB54.2 is restricted (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

Harbor Head (MA95-46) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|--------------|-------------------------|-----------|---------|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | | |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | | Unknown | On-site treatment systems (septic systems), highway/ road runoff, municipal separate storm sewer systems |
| Primary Contact |  | NOT ASSESSED | | | | |
| Secondary Contact |  | NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

* For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS HARBOR HEAD (MA95-46)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a survey to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, septic system improvements, sewerage, and the Phase II community storm water management program and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacterial inputs to Harbor Head. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Develop a nutrient/bacteria TMDL for the West Falmouth Harbor system in accordance with the Massachusetts Estuaries Project.

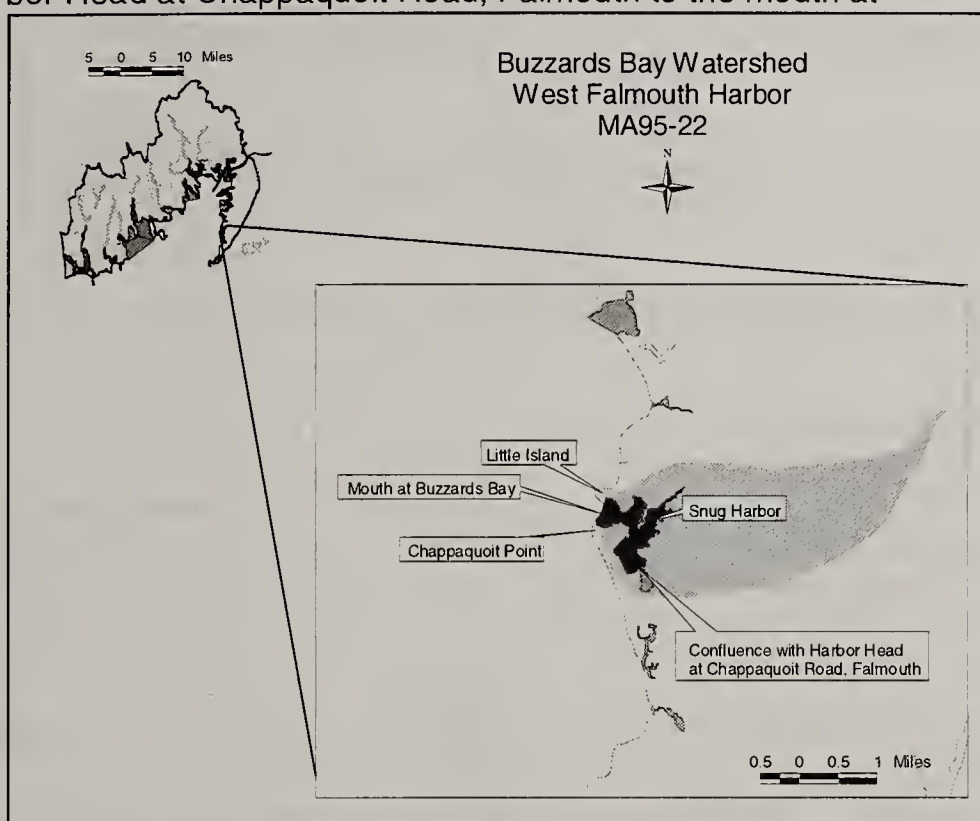
WEST FALMOUTH HARBOR (SEGMENT MA95-22)

Location: From the confluence with Harbor Head at Chappaquoit Road, Falmouth to the mouth at Buzzards Bay at a line connecting the ends of the seawalls from Little Island and Chappaquoit Point, Falmouth (including Snug Harbor)
Segment Area: 0.29 square miles
Classification: Class SA

The recharge area of this segment is approximately 3.5 square miles and includes segment MA95-46. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 48% |
| Residential | 27% |
| Industrial | 15% |

This segment is on the Massachusetts 1998 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999). As part of the Estuaries Project a nutrient/bacteria TMDL will be developed by SMAST in the next few years for the West Falmouth Harbor system.









According to the Coalition for Buzzards Bay *Baywatchers II* report, the harbor contains 356 moorings and is highly used by recreational boaters. The inner harbor (Snug Harbor) has both a Town Dock and public boat ramp. Boat fueling and pump out facilities at the Town Dock are no longer available (MA EOEA 2003).

West Falmouth Harbor is notable for its diversity of nitrogen sources, among them the Town's only Waste Water Treatment Facility (WWTF), its landfill, old septage lagoons, composting installations, runoff from roads and lawns, as well as effluent from a growing number of residential septic systems and from the Town's industrial park. The WWTF presents the largest source of nitrogen. It currently processes 0.55 MGD with a capacity of 0.81 MGD and discharges to groundwater. A \$14 million upgrade has been approved to bring the capacity up to 1.0 MGD in the next few years. There is also a nitrogen enriched groundwater plume originating from the Falmouth Landfill and the now closed septage disposal lagoons at the landfill. The Harbor is projected to experience a more than 33% increase in total nitrogen load from 1998 to 2004 (Cape Cod Commission 1998).

The Town of Falmouth will install infiltration technology to treat storm water to reduce bacterial contamination to West Falmouth Harbor using funds awarded in 2000 by the MA CZM Coastal Remediation Program. Also, the West Falmouth Harbor Management Committee formed in 2000 is working on the development of a harbor management plan (MA EOEA 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at five stations in West Falmouth Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted by the Falmouth Pond Watchers at nine stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Nitrogen sources identified by the Coalition include the WWTF, storm water from road runoff and residential development, and the nitrogen enriched groundwater plume from the Falmouth Landfill and its former septage lagoons. Oxygen depletion (defined by CBB as <60% saturation) within the inner regions of the harbor is common and nitrogen levels are consistently higher and appear to coincide with the WWTF plume (Howes *et al.* 1999). The average

West Falmouth Harbor (MA95-22) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|---|---|----------------|--|---|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | IMPAIRED | Estuarine bioassessment (decline of eelgrass bed habitat) | Total nitrogen | On-site treatment systems (septic systems), septage disposal (landfill lagoon), municipal point source discharge (groundwater) | |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 0.09 mi ² SUPPORT 0.20 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | On-site treatment systems (septic systems), highway/road runoff, municipal separate storm sewer systems |
| Primary Contact |  | 0.09 mi ² SUPPORT 0.20 mi ² NOT ASSESSED | | | | |
| Secondary Contact |  | 0.09 mi ² SUPPORT 0.20 mi ² NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

* For watershed-wide shellfish growing area data see Appendix E

RECOMMENDATIONS WEST FALMOUTH HARBOR (MA95-22)

- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a survey to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, septic system improvements, sewerage, and the Phase II community storm water management program and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacteria loading to West Falmouth Harbor. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Develop a nutrient/bacteria TMDL for the West Falmouth Harbor system in accordance with the Massachusetts Estuaries Project.
- Implement the salt marsh restoration projects identified in the *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* (2002) that have been evaluated and prioritized by the Town. Sites in this subwatershed are FA15, FA16, FA17, FA, FA19, FA29, FA30, FA31, FA32, FA33, and FA34. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.
- Implement the recommendations from the EOEA Cape Cod Watershed Action Plan (MA EOEA 2003) including:
 - implement BMP for storm drain on Route 28A draining to West Falmouth Harbor, and
 - implement a storm water best management practice for the treatment of polluted roadway runoff contained in the Old Dock Road drainage system and discharging in West Falmouth Harbor.

GREAT SIPPEWISSET CREEK (SEGMENT MA95-23)

Location: From the outlet of Beach Pond in Great Sippewissett Marsh to the mouth at Buzzards Bay, Falmouth, including the unnamed tributary from the outlet of Fresh Pond, and Quahog Pond, Falmouth.

Segment Area: 0.03 square miles

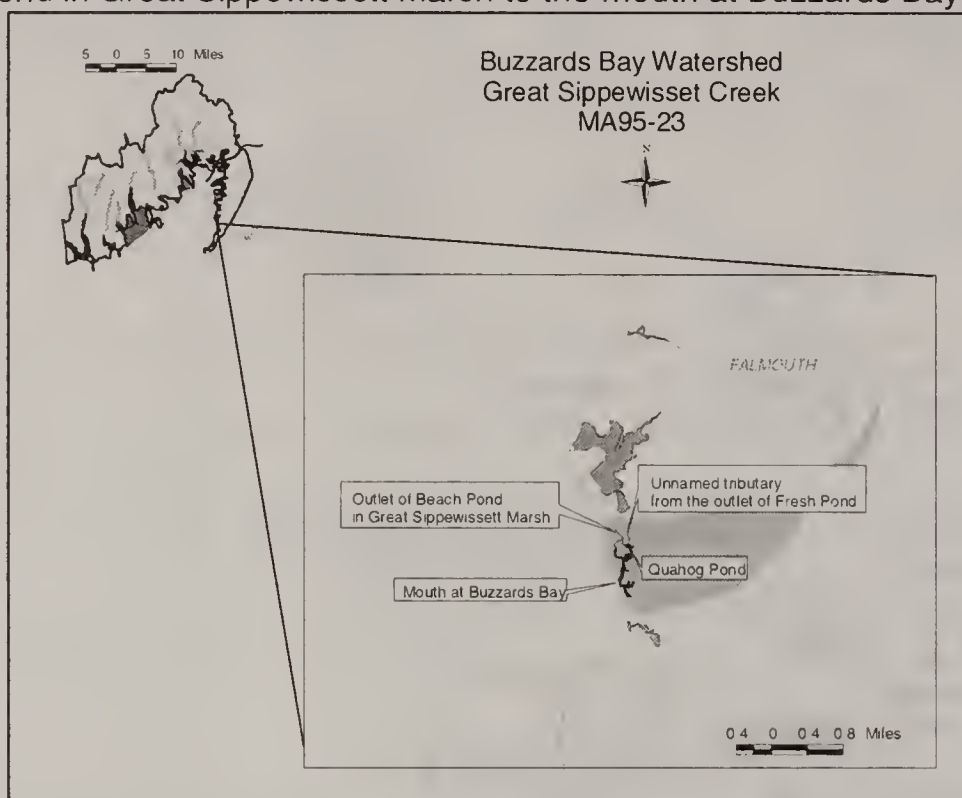
Classification: Class SA

The recharge area of this segment is approximately 2.0 square miles. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 56% |
| Residential | 20% |
| Wetlands | 10% |

This segment is on the Massachusetts 1998 303(d) List of Waters, in the Cape Cod

Watershed, as not meeting the water quality standards for pathogens (MA DEP 1999).



The Great Sippewissett Creek Subwatershed is located in the town of Falmouth. Route 28 and 28A run through the area. The residential development is moderately dense, with very little commercial development. Long Pond, partially located in this subwatershed, is the source for Falmouth's municipal water. There is one hazardous waste 21E site located at Falmouth High School on Gifford Street (MA EOE 2003).

The Cape Cod Commission designated the Black Beach/Great Sippewissett Marsh a *District of Critical Planning Concern* in 1996 to protect the 340 acres of sensitive marsh and barrier beach. The Town nominated the district to prevent flood damage, improve water quality, protect important plant and wildlife habitat, manage storm water runoff, protect finfish and shellfish, and minimize harmful effects of new development. The Town developed regulations that included clearing and grading limitations, prohibition of wetland alteration, increased wetland buffers, improvements to septic systems and storm water drainage, protections to flood zones and dunes, and other regulations (MA EOE 2003).

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|---------------------------|---------|-------------------|-------------------------|---|---|--------------------------|-------|-------|
| | | | | | | 1999 | 2000 | 2001 |
| Falmouth Water Department | 4096000 | 9P4220960 | 42209607 | Long Pond Reservoir 4096000-01S Mares Pond Well 4096000-004G | Registered = 2.95** Permitted = 1.36** | 0.331 | 0.274 | 0.328 |

*Excludes registered cranberry growers ** Includes sources outside this subwatershed

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated NPDES wastewater discharges in this segment. It should be noted, however, that Falmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).






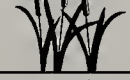
USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB56.0 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* for this entire segment is assessed as impaired.

Great Sippewisset Creek (MA95-23) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|--------------|-------------------------|-----------|---------|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | | |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | | Unknown | On-site treatment systems (septic systems), highway/ road runoff |
| Primary Contact |  | NOT ASSESSED | | | | |
| Secondary Contact |  | NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

*For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS GREAT SIPPEWISSET CREEK (MA95-23)

- Design and conduct a survey to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to reduce bacteria inputs to Great Sippewisset Creek. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Implement the salt marsh restoration projects identified in the *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* (2002) that have been evaluated and prioritized by the Town. Sites in this subwatershed are FA22, FA28, FA28A, FA20, FA21, FA27, and FA26. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

LITTLE SIPPEWISSET MARSH (SEGMENT MA95-24)

Location: From the headwaters north of Sippewisset Road, Falmouth to the mouth at Buzzards Bay near Saconesset Hills, Falmouth.

Segment Area: 0.02 square miles

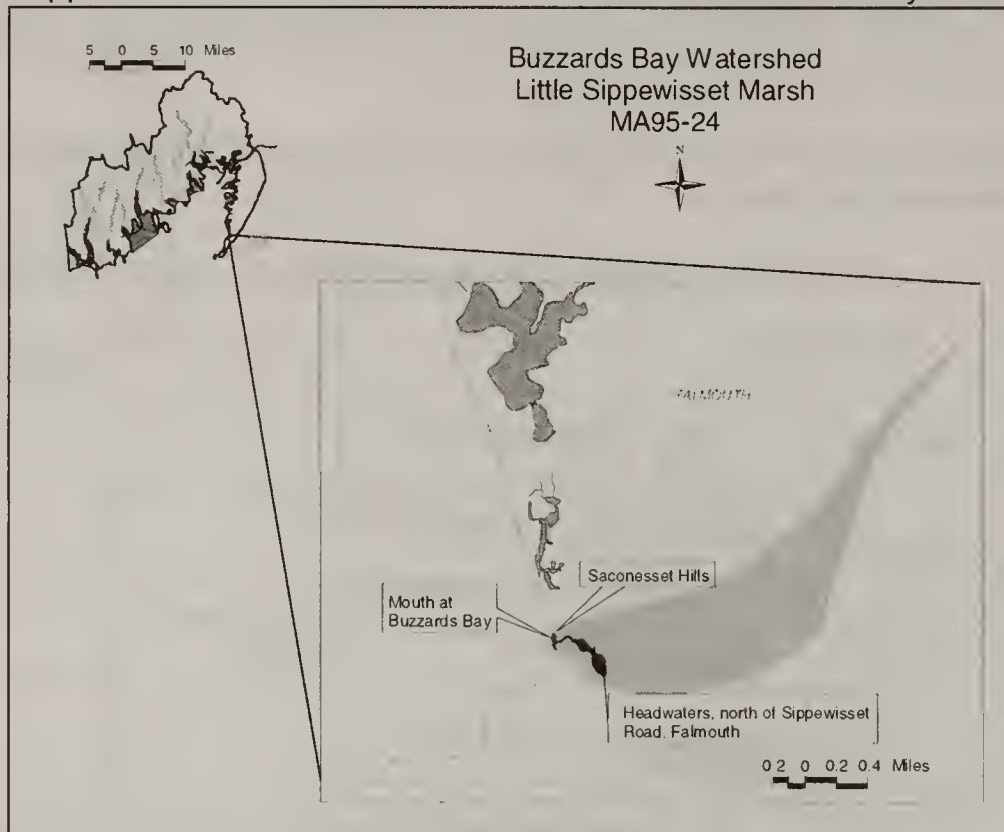
Classification: Class SA

The drainage area of this segment is approximately 1.2 square miles. Land-use estimates (top three, excluding water) for the subwatershed (map inset, gray shaded area):

| | |
|-------------|-----|
| Forest | 56% |
| Residential | 21% |
| Wetlands | 5% |

This segment is on the Massachusetts 1998 303(d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

Much of the drainage area is undeveloped though there is some residential development. Long Pond, the source for Falmouth's municipal water, is located in this drainage area (MA EOEA 2003).



In 2000 the Coalition for Buzzards Bay began conducting water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at one station in Little Sippewisset Marsh between May and September. Samples have been collected between 6 and 9 am.

WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|---------------------------|---------|-------------------|-------------------------|------------------------------------|---|--------------------------|-------|-------|
| | | | | | | 1999 | 2000 | 2001 |
| Falmouth Water Department | 4096000 | 9P4220960 | 42209607 | Long Pond Reservoir 4096000-01S | Registered = 2.95** Permitted = 1.36** | 2.675 | 2.570 | 2.687 |

* Exclude registered cranberry growers **Includes sources outside this subwatershed

NPDES SURFACE DISCHARGE SUMMARY

There are no regulated water withdrawals or NPDES wastewater discharges in this segment. It should be noted, however, that Falmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).







USE ASSESSMENT

SHELLFISH HARVESTING

The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB57.0 is prohibited (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as impaired for this entire segment.

Little Sippewisset Marsh (MA95-24) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|--------------|-------------------------|-----------|---------|--|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | | |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | IMPAIRED | Fecal coliform bacteria | | Unknown | On-site treatment systems (septic systems), highway/ road runoff |
| Primary Contact |  | NOT ASSESSED | | | | |
| Secondary Contact |  | NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

* For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS LITTLE SIPPEWISSET MARSH (MA95-24)

- Design and conduct a bacteria monitoring survey to document effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to mitigate bacterial inputs to Little Sippewisset Marsh. Continue to review DMF shellfish status report to assess the *Shellfish Harvesting Use*.
- Implement the salt marsh restoration project identified in the *Atlas of Tidally Restricted Salt Marshes – Buzzards Bay Watershed, Massachusetts* (2002) that have been evaluated and prioritized by the Town. The one site in this subwatershed is FA10. Develop a plan to monitor the effectiveness of the restoration, improvements in water quality, and affects on aquatic life.

QUISSETT HARBOR (SEGMENT MA95-25)

Location: The semi-enclosed body of water landward of a line drawn between The Knob and Gansett Point, Falmouth

Segment Area: 0.17 square miles

Classification: Class SA

The recharge area of this segment is approximately 0.8 square miles. Land-use estimates (top three, excluding water) for the water recharge area (map inset, gray shaded area):

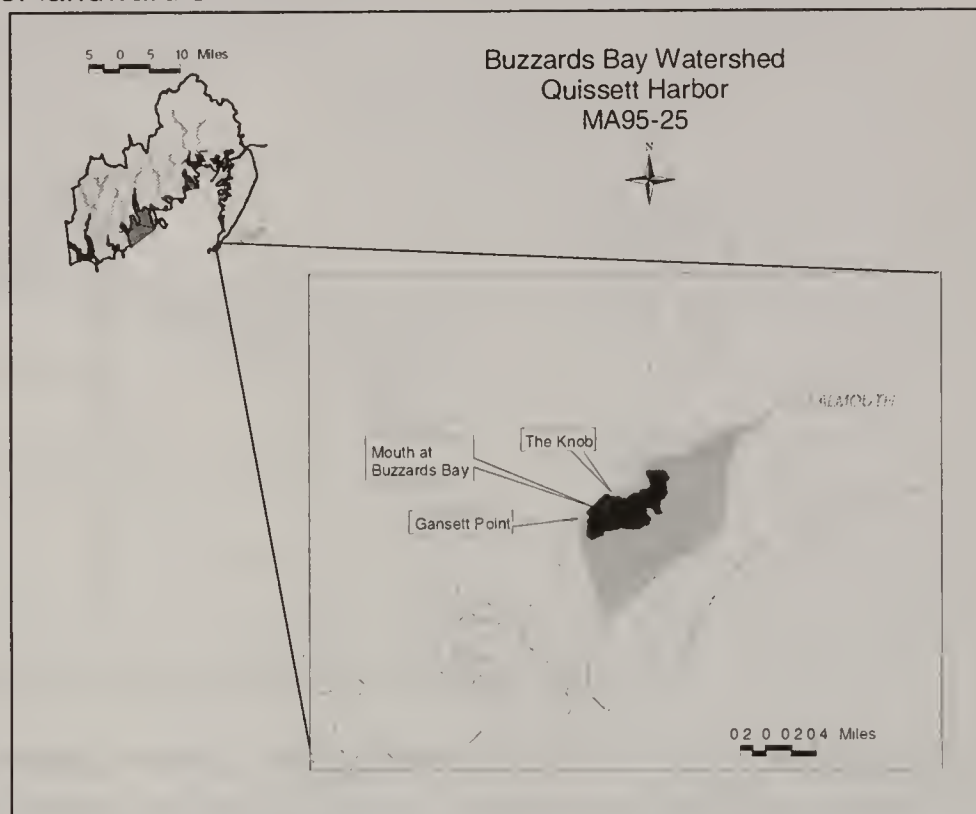
| | |
|-------------|-----|
| Forest | 46% |
| Residential | 35% |
| Open land | 16% |

This segment is on the Massachusetts 1998 303 (d) List of Waters as not meeting the water quality standards for pathogens (MA DEP 1999).

Quissett Harbor is one of the deepest embayments in Buzzards Bay. It has high tidal flushing, no freshwater inputs, and a healthy eelgrass population. The harbor supports beds of scallops, oysters, quahogs, and soft-shell clams (MA EOEa 2003).

The harbor receives a high volume of recreational boat use. A year round pump out facility is located at the Quissett Harbor Boatyard. In addition to the boat yard, there are 240 moorings and a public landing on northeast shore of the harbor. In January 1999 the Town approved a management plan for Quissett Harbor. There is a high demand for moorings but no room to accommodate more parking or a septic system for a bathhouse. The Harbor exceeds the number of commercial moorings recommended, but several moorings have been moved from the inner to the outer harbor to accommodate the number of private moorings needed in the inner harbor (MA EOEa 2003).

The Coalition for Buzzards Bay has been conducting weekly water quality monitoring for dissolved oxygen, temperature, salinity, and water clarity (Secchi depth) at two stations in Quissett Harbor between May and September from 1992 to the present. Samples were collected between 6 and 9 AM. More intensive sampling of nutrients was conducted at two stations at two week intervals between July and August for organic nitrogen, particulate organic carbon, dissolved nitrogen, dissolved phosphorus, and chlorophyll *a*. Sources of nitrogen loading to the harbor include residential on-site septic systems and the Woods Hole Golf Club. The Harbor supports healthy eelgrass beds, especially in the outer areas, although historic beds have been lost in the inner areas south of Quissett Harbor Road (Howes *et al.* 1999). The average 1997-2001 Health Index Score for inner Quissett Harbor was 78.5 and for outer Quissett Harbor was 90.3 (good/excellent) (CBB Undated b).



WMA WATER WITHDRAWAL SUMMARY* (APPENDIX F)

| Facility | PWS ID | WMA Permit Number | WMA Registration Number | Source (G = ground) | Authorized Withdrawal (MGD) | Average Withdrawal (MGD) | | |
|------------------------|--------|-------------------|-------------------------|---------------------|-----------------------------|--------------------------|------|------|
| | | | | | | 1999 | 2000 | 2001 |
| Woods Hole Golf Club** | | | 42209606 | Wells #1 and #2 | 0.08 | 0.07 | 0.06 | 0.08 |

* Excludes registered cranberry growers ** Indicates average withdrawal over less than 365 days

NPDES SURFACE DISCHARGE SUMMARY

There are no NPDES wastewater discharges in this segment. It should be noted, however, that Falmouth is a Phase II community and has submitted their notice of intent for permit coverage for their NPDES Municipal (MS4) drainage system. Their coverage requires that they develop, implement, and enforce a

storm water management program and reduce the discharge of pollutants from their system over the five-year permit term (Scarlet 2003).

USE ASSESSMENT

SHELLFISH HARVESTING







The DMF Shellfish Status Report of July 2000 indicates that shellfish growing area BB58.0 is approved and BB58.2 is conditionally approved (DFWELE 2000).

Based on the DMF shellfish growing area status the *Shellfish Harvesting Use* is assessed as support for 0.1 mi² and impaired for 0.05 mi².

PRIMARY AND SECONDARY CONTACT RECREATION

Based on the more stringent shellfish harvesting guidelines the *Primary and Secondary Contact Recreational Uses* are assessed as support for 0.1 mi². The remaining 0.05 mi² are currently not assessed.

Quissett Harbor (MA95-25) Use Summary Table

| Designated Uses | | Status | Causes | | Sources | |
|-----------------------|---|---|-------------------------|-----------|---------|---|
| | | | Known | Suspected | Known | Suspected |
| Aquatic Life |  | NOT ASSESSED | | | | |
| Fish Consumption |  | NOT ASSESSED | | | | |
| Shellfish Harvesting* |  | 0.11 mi ² SUPPORT 0.06 mi ² IMPAIRED | Fecal coliform bacteria | | Unknown | On-site treatment systems (septic systems), road runoff |
| Primary Contact |  | 0.11 mi ² SUPPORT 0.06 mi ² NOT ASSESSED | | | | |
| Secondary Contact |  | 0.11 mi ² SUPPORT 0.06 mi ² NOT ASSESSED | | | | |
| Aesthetics |  | NOT ASSESSED | | | | |

* For watershed-wide shellfish growing area data see Appendix E.

RECOMMENDATIONS FOR QUISSETT HARBOR (MA95-25)

- Work with the Coalition for Buzzards Bay to promote stewardship and implement environmentally friendly practices that will help reduce the leaching of fertilizers from the Woods Hole Golf Club and residential properties into Quissett Harbor.
- Work with the Buzzards Bay Coalition to improve quality assurance procedures, data exchange, and, if deemed necessary, increase spatial and temporal coverage of *in-situ* monitoring. Review final reports when evaluating the status of the *Aquatic Life Use*.
- Design and conduct a survey to monitor bacteria levels to document effectiveness of bacteria source reduction activities including treatment of storm water discharges, septic system improvements, and the Phase II community storm water management programs and to assess the recreational uses.
- Review and implement, as appropriate, recommendations from DMF shellfish sanitary survey and triennial reports to remediate sources of bacteria to Quissett Harbor. Continue to review DMF shellfish status reports to assess the *Shellfish Harvesting Use*.
- Continue to support efforts to map the distribution of eelgrass beds throughout the Buzzards Bay Watershed and continue to examine the health and biovolume of the plants as indicators of water quality. Continue to review data to assess the *Aquatic Life Use*.

BUZZARDS BAY WATERSHED – LAKE SEGMENT ASSESSMENTS

A total of 173 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned Pond And Lake Information System (PALIS) code numbers in the Buzzards Bay Watershed (Ackerman 1989 and MA DEP 2002d). One hundred forty-three (143) of the lakes are less than 50 acres in total surface area; three are 50 acres; ten are between 50 and 100 acres; ten are between 100 and 200 acres; five are between 200 and 500 acres; and two are 500- 700 acres in total surface area. The total surface area of the Buzzards Bay Watershed lakes is 7,106 acres. This report presents information on 69 of the Buzzards Bay Watershed lakes that are listed in the WBS database. The remaining 103 lakes, which total 2,740 acres, are unassessed and are not currently included as segments in the WBS database.

The 69 lakes assessed in this report represent 4,366 of the 7,106 acres, or 61%, of the total lake acreage in the Buzzards Bay Watershed. The majority of the lakes assessed in the Buzzards Bay Watershed are located within the three communities in the northeastern most portion of the watershed; Plymouth (29), Wareham (13), and Carver (12). Baseline lake surveys were conducted on seven of these lakes (TMDL sampling) in the summer of 2000 (Appendix A, Tables A2 and A3). Synoptic surveys were conducted by DWM at 64 of these lakes in 1995 (Appendix A, Table A1). (Two of the lakes were sampled in both 1995 and 2000.)

Public boat launches are located on three of the assessed lakes: Big Sandy (MA95011), Long (MA95096), and Snipatuit (MA95137) Ponds. The launch at Long Pond is asphalt and is maintained by the Department of Environmental Management, Division of Forest and Parks. There are 50 parking spaces available at this site. MassWildlife maintains one gravel boat launch on Big Sandy Pond with six parking spaces. MassWildlife also maintains one concrete launch at Sniaptuit Pond where there are five parking spaces available (DFWELE 2002).

The Department of Environmental Management, Lakes and Ponds Program works with local groups and municipalities to protect, manage, and restore these valuable aquatic resources. MA DEM provides grant funding and technical assistance to communities and citizen groups, helps to monitor water quality at various public beaches to ensure public safety, and provides educational materials to the public about various lake issues <http://www.state.ma.us/dem/programs/lakepond/lakepond.htm>. Four communities have received MA DEM Lakes and Pond Grants since 1999 as summarized below.

The Town of Dartmouth and the Lake Noquochoke Association were awarded a MA DEM Lakes and Pond Grant in 1999 to prepare a lake and watershed management plan for Noquochoke Lake (Segments MA95113, MA95170, and MA95171). The project examined the ecological impacts of excessive eutrophication through a limnological investigation. The resulting plan recommended appropriate long-term remediation measures to restore the pond.

The Town of Carver was also awarded a MA DEM Lakes and Pond Grant in 1999 to develop a master plan for septic system management in close proximity to Vaughn Pond (Segment MA951153). The project included locating septic systems and wells, conducting water quality analysis, developing the plan, and developing recommendations for mitigation of nutrient loading to the pond from septic systems and groundwater flow.

The Town of Acushnet was awarded a MA DEM Lakes and Pond Grant in 2001 to develop a lake and watershed management plan for the New Bedford Reservoir (Segment MA95110). ENSR International was contracted by the Town of Acushnet to examine land use; conduct chemical sampling; conduct phytoplankton surveys; and examine the aquatic vascular plant communities (ENSR 2002).

The Town of Dartmouth was awarded a 2001 MA DEM Lake and Pond Grant to control the spread of variable milfoil (*Myriophyllum heterophyllum*) for the use of herbicides on Lake Noquochoke, which is adversely affecting recreational pursuits and the ecosystem of the pond.

MA DEM manages the Myles Standish State Forest, the largest publicly owned recreation area in southeastern Massachusetts. The Forest contains 16 ponds (only five ponds listed in this report). Several

of the ponds are “ecologically significant coastal plain kettle ponds” (MA DEM Undated c). MA DEM collected bacteria data from five of the facility’s 16 ponds that have public bathing beaches.

The Six Ponds Improvement Association monitors the water quality of Long, Little Long, Halfway, Round, Gallows and Bloody ponds in South Plymouth. Little Long, Long, and Halfway ponds (Segments MA95088, MA95096, and MA95178, respectively) are located in the Buzzards Bay Watershed. Surveys were conducted over the past six years using state certified laboratory analyses of 21 chemical parameters plus other objective observations and measurements. A temporally and spatially intensive survey program was begun in 2002 to document existing baseline conditions of these six ponds and to identify possible contaminant sources. Six Ponds Improvement Association is currently developing a Quality Assurance Project Plan. Moreover, the Six Ponds Improvement Association together with other community organizations is soliciting and organizing volunteers from other Plymouth ponds to assist in building a database of pond conditions throughout the town. As this information is gathered it will become available on the web site of the Plymouth Water Quality Task Force (www.plymouthwaterquality.org) (Russell 2003).

The Nature Conservancy is beginning a program to monitor 12 coastal plain ponds in Plymouth, Carver, and Kingston under the Plymouth PondWatchers Program. Five of the 12 ponds, Darby, Halfway, Little Widgeon, Micajah, and Widgeon are in the Buzzards Bay Watershed. However, only Micajah Pond (MA95102) and Halfway Pond (MA95178) are currently designated as segments in the Water Body System. Sampling in 2002 occurred during the months of August, September, October, and November. Parameters measured included turbidity, temperature, dissolved oxygen, pH, fecal coliform bacteria, total phosphorus, and nitrate-nitrogen. The Nature Conservancy applied to the Massachusetts Environmental Trust for an FY03 grant to continue their program.

LAKE USE ASSESSMENTS

Lake assessments are based on information gathered during DWM surveys (recent and historic) as well as pertinent information from other reliable sources (e.g., abutters, herbicide applicators, diagnostic/feasibility studies, MDPH, etc.). The 1995 DWM synoptic surveys focused on observations of water quality and quantity (e.g., water level, sedimentation, etc.), the presence of native and non-native aquatic plants (as well as distribution and areal cover), and presence/severity of algal blooms (Appendix A, Table A1). During 2000 more intensive in-lake sampling was conducted by DWM in eight lakes in the Buzzards Bay Watershed as part of the TMDL program. This sampling included in-lake measurements of dissolved oxygen, pH, temperature, Secchi disk transparency, nutrients, and chlorophyll *a*, and detailed macrophyte mapping (Appendix A, Tables A2 and A3). While these surveys provided additional information to assess the status of the designated uses, bacteria (fecal coliform, *E. coli*, or *Enterococcus*) data were not collected by DWM and, therefore, the *Primary Contact Recreational Use* was usually not assessed. Under the beaches bill public and semi-public beaches are required to conduct bacteria monitoring and report closure information to MDPH. Beach closure information provide by MDPH was used to assess the *Primary* and *Secondary Contact Recreational Uses* where applicable (MDPH 2002b). To determine the status of the *Fish Consumption Use* fish consumption advisory information was obtained from MDPH (MDPH 2002c). Although the *Drinking Water Use* was not assessed in this water quality assessment report, the Class A waters were identified. Information on drinking water source protection and finish water quality is available at <http://www.state.ma.us/dep/brp/dws/dwshome.htm> and from the Buzzards Bay Watershed’s public water suppliers.

The use assessments and supporting information were entered into the EPA Water Body System database. Data on the presence of non-native plants from the 1995 DWM synoptic surveys, the 2000 DWM TMDL surveys, and other reliable sources were entered into the MA DEP DWM informal non-native plant-tracking database.

AQUATIC LIFE

As part of the 104 (b)(3) grant project (99-06/104) *Lake Surveys for TMDL Development*, DFWELE conducted fish population surveys in two of the eight TMDL lakes in the Buzzards Bay Watershed in 2000: Federal Pond, Carver (MA95055) and Parker Mills Pond, Wareham (MA95115). The objective of the project was to determine if a relationship existed between fish population parameters and macrophyte levels. Fish populations were surveyed using night boat-electroshocking, gill nettings, and beach seining. Aquatic vegetation sampling to estimate extent, density, and biovolume was also conducted. Statistical analysis showed no significant relationships between aquatic vegetation density/biovolume and fisheries parameters. However, given the small sample set, it is predicted that with additional data statistically significant relationships will become apparent. Additional sampling is recommended (Hartley 2003). Fish population data are presented in Table 4.

DFWELE also conducted fish population assessments in eight lakes in the Water Body System within the Buzzards Bay Watershed during the summers of 1998-2000 (Richards 2003 and Hurley 2003). Collection methods included boat electrofishing, experimental gillnets, and/or seines. The species lists and counts for fish are provided in Table 5. A watershed based fisheries management plan will be produced for the Buzzards Bay Watershed by DFWELE at a later date.

Table 4. Fish species-level taxa list and counts for Parker Mill Pond and Federal Pond. Fish collected by the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Fisheries and Wildlife between July and September 2000 in ponds of the Buzzards Bay Watershed as part of the 99-06/104 grant project *Lakes Survey for TMDL Development*. Collection methods included boat shocking, gillnets, and/or seines (Hartley 2003).

| Common Name | Scientific Name | Parker Mill Pond (MA95115) | Federal Pond (MA95055) |
|--------------------|--------------------------------|-------------------------------|---------------------------|
| American eel | <i>Anguilla rostrata</i> | 36 | 5 |
| Bluegill | <i>Lepomis macrochirus</i> | 109 | 203 |
| Brown bullhead | <i>Ameiurus nebulosus</i> | 10 | 7 |
| Black crappie | <i>Pomoxis nigromaculatus</i> | --- | 2 |
| Banded sunfish | <i>Enneacanthus obesus</i> | 1 | --- |
| Chain pickerel | <i>Esox niger</i> | 27 | 46 |
| Golden shiner | <i>Notemigonus crysoleucas</i> | 149 | 2 |
| Largemouth bass | <i>Micropterus salmoides</i> | 126 | 71 |
| Pumpkinseed | <i>Lepomis gibbosus</i> | 52 | 5 |
| Tessellated darter | <i>Etheostoma olmstedii</i> | --- | 4 |
| Yellow bullhead | <i>Ameiurus natalis</i> | 4 | --- |
| Yellow perch | <i>Perca flavescens</i> | 29 | --- |

Table 5. Species-level taxa list and counts for fish for Spectacle, Whites, Halfway, White Island, Little Long, and Long ponds, New Bedford Reservoir and Noquochoke Lake. Fish collected by the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement, Division of Fisheries and Wildlife, Southeast District between July 1998 and September 2000 in lakes and ponds in the Buzzards Bay Watershed (Hurley 2003a, b, and c). Collection methods included boat shocking, experimental gillnets, angling, and/or seines.

| Common Name | Scientific Name | Spectacle Pond (MA95142) 1 July 1998 | Whites Pond (MA95168) 29 July 1998 | Halfway Pond (MA95178) 17 July 2000 | New Bedford Reservoir (MA95110) 7 August 2000 | White Island Pond (MA95166 and MA95173) 21 August 2000 | Noquochoke Lake (MA95113, MA95170, and MA95171) 28 August 2000 | Little Long Pond (MA95088) 11 September 2000 | Long Pond (MA95096) 11 September 2000 |
|------------------|--------------------------------|--|--|---|---|--|--|--|---|
| American eel | <i>Anguilla rostrata</i> | Few | --- | Sparse | Few | Few | Very abundant | Abundant | 4 |
| Alewife | <i>Alosa pseudoharengus</i> | 26 | --- | 57 | --- | 83 | --- | --- | --- |
| Blueback herring | <i>Alosa aestivalis</i> | --- | --- | --- | 1 | --- | --- | --- | --- |
| Chain pickerel | <i>Esox niger</i> | 13 | 12 | 1 | 7 | 18 | 7 | 4 | --- |
| Golden shiner | <i>Notemigonus crysoleucas</i> | 4 | --- | --- | --- | 1 | 10 | --- | --- |
| White sucker | <i>Catostomus commersoni</i> | 1 | --- | 18 | --- | --- | --- | 23 | 3 |

Table 5 (Continued). Species-level taxa list and counts for fish for Spectacle, Whites, Halfway, White Island, Little Long, and Long ponds, New Bedford Reservoir and Noquochoke Lake. Fish collected by the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement, Division of Fisheries and Wildlife, Southeast District between July 1998 and September 2000 in lakes and ponds in the Buzzards Bay Watershed (Hurley 2003a, b, and c). Collection methods included boat shocking, experimental gillnets, angling, and/or seines.

| Common Name | Scientific Name | Spectacle Pond (MA95142) 1 July 1998 | Whites Pond (MA95168) 29 July 1998 | Halfway Pond (MA95178) 17 July 2000 | New Bedford Reservoir (MA95110) 7 August 2000 | White Island Pond (MA95166 and MA95173) 21 August 2000 | Noquochoke Lake (MA95113, MA95170, and MA95171) 28 August 2000 | Little Long Pond (MA95088) 11 September 2000 | Long Pond (MA95096) 11 September 2000 |
|--------------------------------|-------------------------------|--------------------------------------|------------------------------------|-------------------------------------|---|--|--|--|---------------------------------------|
| Brown bullhead | <i>Ameiurus nebulosus</i> | 1 | 2 | --- | --- | 6 | --- | --- | 1 |
| Banded killifish | <i>Fundulus diaphanus</i> | 2 | --- | 5 | --- | 12 | --- | Abundant | 12 |
| Pumpkinseed | <i>Lepomis gibbosus</i> | 36 | 20 | 17 | 15 | 34 | 40 | --- | 23 |
| Bluegill | <i>Lepomis macrochirus</i> | 14 | --- | 23 | 66 | 2 | 54 | 12 | 25 |
| Sunfish (undetermined species) | <i>Lepomis sp.</i> | --- | --- | --- | 2 | --- | --- | --- | 28 |
| Largemouth bass | <i>Micropterus salmoides</i> | 29 | 12 | 19 | 25 | 88 | 46 | 30 | 12 |
| Yellow perch | <i>Perca flavescens</i> | 98 | 137 | 172 | 34 | 323 | 72 | 14 | 4 |
| White perch | <i>Morone americana</i> | --- | --- | 13 | 10 | 16 | --- | 2 | 23 |
| Black crappie | <i>Pomoxis nigromaculatus</i> | --- | --- | 1 | 18 | --- | --- | --- | --- |
| Smallmouth bass | <i>Micropterus dolomieu</i> | --- | --- | 25 | --- | 54 | --- | 12 | 61 |
| Tessellated darter | <i>Etheostoma olmsted</i> | --- | --- | 5 | --- | --- | --- | --- | --- |

Non-native aquatic macrophytes were observed in 13 of the 64 lakes surveyed by DWM in 1995 (Appendix A, Table A1). The non-native aquatic species observed in the Buzzards Bay Watershed lakes were *Myriophyllum heterophyllum* (variable water milfoil) and *Cabomba caroliniana* (fanwort). *M. heterophyllum* and *Cabomba caroliniana* have a high potential for spreading and are likely to have established themselves in downstream lake and river segments in the Buzzards Bay Watershed that may not have been surveyed. Figure 17 indicates where non-native aquatic species were observed during the DWM 1995 and/or 2000 surveys and the likely, or potential, avenues of downstream spreading.

Additionally, *M. heterophyllum* is suspected to be present in seven ponds in the Buzzards Bay Watershed (Appendix A, Table A1 and Table 6). At the time of the DWM surveys these plants had not matured sufficiently for positive identification. Because *M. heterophyllum* is suspected the *Aquatic Life Use* for these lakes is identified with an "Alert Status".

Lythrum salicaria (purple loosestrife) was identified at four of the 64 lakes surveyed by DWM in 1995 and/or 2000 (Appendix A, Table A1) and *Phragmites australis* (common reed) was identified at six. Although the presence of these species is not generally a cause of impairment to lakes, their invasive growth habit can result in the impairment of wetland habitat associated with lakes.

New Bedford Reservoir was sampled by ENSR on two occasions (June and August 2002) as part of a D/F Study for the Town of Acushnet. Temperature, pH, specific conductance, Secchi transparency, turbidity, total alkalinity, nitrate and nitrite, ammonia, total Kjeldahl nitrogen, total phosphorus and ortho-phosphorus samples were collected; phytoplankton surveys were conducted; and the aquatic vascular plant communities were examined (ENSR 2002). Unfortunately, this dataset does not meet minimum acceptance criteria required by EPA and MA DEP for use in reporting 305(b) assessments.

DWM, with assistance from DFWELE, conducted baseline sampling at eight lakes in the Buzzards Bay Watershed identified below for TMDL development. Samples collected between July and September 2000 included *in-situ* physical parameters using a Hydrolab Multiprobe[®] and grab samples for chemical analysis of alkalinity, total phosphorus, apparent color, and chlorophyll *a*. A technical memorandum entitled *Baseline Lake Survey 2000 Technical Memo* presents the results of DWM's 2000 Baseline Lakes Monitoring (Mattson 2003). Data pertaining to lakes within the Buzzards Bay Watershed were excerpted and appear in Appendix A.

- Turner Pond (MA95151), New Bedford
- New Bedford Reservoir (MA95110), Acushnet
- East White Island Pond (MA 95166), Plymouth
- West White Island Pond (MA95173), Plymouth
- New Long Pond (MA95112), Plymouth
- Crane Brook Pond (MA95033), Carver
- Federal Pond (MA95055), Carver
- Parker Mills Pond (MA95115), Wareham

DWM sampling of the north basin of New Bedford Reservoir in July, August, and September 2000 found dissolved oxygen depletion (5.7 mg/L-1.7 mg/L) and moderate total phosphorus concentrations (0.021-0.070 mg/L) indicative of an organic-enriched system (Appendix A, Table A2 and A3). The non-native aquatic plant *Myriophyllum heterophyllum* was identified in both the 1995 synoptic surveys and 2000 TMDL surveys.

Approximately 80% of the surface area in the north basin has dense to very dense aquatic vegetation biovolume below it. The south basin showed generally good dissolved oxygen concentrations and low levels of total phosphorus, with the exception of one inlet draining the cranberry bog at the northeastern corner of the basin. Less than 20% of the surface area in the south basin has dense/very dense aquatic vegetation biovolume below it. Limited water quality data are available for the east basin of New Bedford Reservoir, however, only about 25% of the surface area there has dense/very dense vegetation biovolume below it. The *Aquatic Life Use* for New Bedford Reservoir is assessed as impaired due to non-native plants, DO, DO saturation, and phosphate. Suspected sources of impairment include storm water (road runoff), on-site septic systems, agricultural and cranberry bog operations, and waterfowl.

Physico-chemical data (low total phosphorus concentrations, good dissolved oxygen levels) collected from New Long Pond in Plymouth indicate that the pond supports the *Aquatic Life Use*. This use is, however, identified with an Alert Status due to very low pH and alkalinity.

Oxygen depletion occurred below 2 m in both the east and west basins of Turner Pond during the summer of 2000. Total phosphorus concentrations in Turner Pond ranged from below the detection limit to 0.10 mg/L in the eastern basin and 0.007 to 0.29 mg/L in the western basin. pH measurements in Turner Pond were very low and color was high (Appendix A, Table A1 and A2). These data are likely indicative of natural conditions associated with the large wetland complex upstream of the pond. The *Aquatic Life Use* is assessed as support for Turner Pond. However, this use is identified with an Alert Status due to elevated total phosphorus concentrations that may be associated with runoff or other anthropogenic sources.

The *Aquatic Life Use* was assessed as impaired (depending on the degree of biocommunity modification) in 13 lakes based on the confirmed presence of non-native macrophyte(s) (Table 6). Four lakes were assessed as impaired as a result of phosphates and/or organic enrichment/low dissolved oxygen. Two lakes in the Buzzards Bay Watershed, New Long Pond in Plymouth and Turner Pond in New Bedford/Dartmouth, are assessed as supporting the *Aquatic Life Use*. Fifty-four lakes are currently not assessed for the *Aquatic Life Use* because of the cursory nature of the synoptic surveys and/or the lack of dissolved oxygen data observations.

FISH CONSUMPTION

In July 2001 MDPH issued new consumer advisories on fish consumption and mercury contamination. The MDPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001)."

Additionally, MDPH "...is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001)."

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. The advisory encompasses all freshwaters in Massachusetts and, therefore, the *Fish Consumption Use* for lakes in the Buzzards Bay Watershed cannot be assessed as support or partial support. The MDPH fish consumption advisory list contains the status of each water body for which an advisory has been issued. If a water body is not on the list it may be because either an advisory was not warranted or the water body has not been sampled. MDPH's most current Fish Consumption Advisory list is available online at <http://www.state.ma.us/dph/beha/fishlist.htm>.]

Fish toxics monitoring was conducted cooperatively by DWM and the DFWLE Division of Fisheries and Wildlife Southeast District Office at two locations recommended by the EOEA Buzzards Bay Team. Fish collections were made using boat electrofishing and gill nets on August 21, 2000 in White Island Pond (Plymouth), and on August 28, 2000 at Noquochoke Lake (Dartmouth). Edible fillets were analyzed for the presence of heavy metals, PCBs, and organochlorine pesticides. Data appear in the technical memorandum by R. Maietta and J. Colonna-Romano entitled *2000 Fish Toxics Monitoring Public Requests and Year 2 Watershed Surveys*. As a result MDPH issued the following fish consumption advisory for Noquochoke Lake due to elevated levels of mercury and PCBs in fish tissue

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Copicut River or Cornell Pond.
2. The general public should not consume any largemouth bass (*Micropterus salmoides*) and American eel (*Anguilla rostrata*) from Noquochoke Lake.

3. The general public should limit consumption of non-affected fish from this waterbody to two meals per month.

In 1995, fish toxics monitoring was conducted by DWM at two locations in the Buzzards Bay Watershed: Snipatuit Pond, Rochester and Glen Charlie Pond, Wareham. As a result MDPH issued the following fish consumption advisory for Snipatuit and Long ponds, Rochester due to elevated levels of mercury in fish tissue:

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any black crappie or largemouth bass from the Snipatuit and Long ponds.
2. The general public should limit consumption of black crappie and largemouth bass from this waterbody to two meals per month.

Two additional site-specific fish consumption advisories were issued by MDPH in the Buzzards Bay Watershed.

Due to elevated levels of mercury and PCBs in fish tissue, MDPH advises the following for Copicut River and Cornell Pond in Dartmouth.

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Copicut River or Cornell Pond.
2. The general public should not consume any American Eel from Copicut River or Cornell Pond.
3. The general public should limit consumption of largemouth bass to two meals per month.

MDPH issued the following advisory for Turner Pond in Dartmouth/New Bedford due to elevated levels of mercury in fish tissue.

1. Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from the Copicut River or Cornell Pond.
2. The general public should limit consumption of all fish from this waterbody to two meals per month.

Based on the MDPH site-specific fish consumption advisories the *Fish Consumption Use* is assessed as impaired for Cornell Pond, Noquochoke Lake, Snipatuit and Long Ponds, and Turner Pond.

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

In 1995 DWM conducted synoptic surveys of 64 lakes in the Buzzards Bay Watershed. These surveys included observations of water quality and quantity, the presence of native and non-native aquatic plants, and the presence/severity of algal blooms (Appendix A, Table A1). Additional data were collected at eight of these lakes by DWM in 2000 for the purpose of TMDL development. These data, combined with the 1998 303(d) List of Waters, MA DEM bathing beach bacteria data, MDPH bathing beach closure information, and diagnostic/feasibility studies were used to assess the recreational and aesthetics uses.

Weekly *Enterococci* bacteria samples were collected from the five MA DEM beaches in the Myles Standish State Forest during 2001 and 2002 between May and August (n=15 at each location). Ponds sampled included Barrett Pond, Charge Pond, College Pond, Curlew Pond, and Fearing Pond. Site-specific information on each pond is provided in the Use Assessment Table (Table 6). No information on beach closures is available (MA DEM 2002 and MDPH 2002b).

Lake Noquochoke was closed to swimming between 6/14-7/2/2001 due to elevated *Enterococci* levels (MDPH 2002b).

Where very dense aquatic macrophyte growth was noted during the 1995 synoptic surveys (Appendix A, Table A1) and there was no knowledge of remedial efforts the assessment of the recreational uses was assessed as impaired (Table 6). In lakes or areas of lakes that were previously unaffected by macrophyte growth the *Primary Contact Recreational Use* was not assessed due to the lack of any current data.

Ten lakes in the Buzzards Bay Watershed were assessed as support for the *Primary Contact* and *Secondary Contact Recreational Uses* (Table 6).

The *Primary Contact* and *Secondary Contact Recreational uses* were impaired for five lakes (1338 acres; 29.8% of the total acreage assessed in this report) in the Buzzards Bay Watershed (Table 6). Causes of impairment included overabundant plant growth (native and/or non-native vegetation), excessive algal growth, phosphate, and Secchi disk transparency. One additional lake, Noquochoke Lake in Dartmouth, was impaired for the *Primary Contact Recreation Use* due to elevated bacteria counts resulting in the closure of the bathing beach. The recreational uses were not assessed for the remaining 52 lakes (2,391 acres).

SUMMARY

A total of 15 of the 67 lakes in the Buzzards Bay Watershed assessed in this report were impaired for one or more uses. Causes of impairment included: noxious (overabundant) plant growth (including both native and non-native vegetation), mercury contamination, PCB contamination, organic enrichment, [low] dissolved oxygen, DO [super] saturation, excessive algal growth, phosphate, and Secchi disk transparency. No lakes supported all uses. Forty-two lakes are currently not assessed for any uses (Table 6).

Due to the focus of the lake surveys conducted the major cause for use impairment documented in this report was growth (in some cases excessive) of aquatic plants, either native or non-native. This cause may reflect symptoms of lake eutrophication, a process of enrichment from excessive plant nutrients. Site-specific sources of impairment to the lakes in the Buzzards Bay Watershed are largely unknown. However, nutrient enrichment from storm water runoff, failing, substandard, or inappropriately sited sewage disposal systems, and/or drainage from agricultural lands is likely to have increased the macrophyte productivity, resulting in impairments to the *Aquatic Life*, *Recreational*, and *Aesthetics* uses.

Cornell Pond in Dartmouth (totaling 16 acres), Noquochoke Lake in Dartmouth (totaling 146 acres), Snipatuit and Long Ponds in Rochester (totaling 743 acres), and Turner Pond in Dartmouth/New Bedford (totaling 55 acres) were impaired for the *Fish Consumption Use* because of PCB and mercury contamination.

Table 6 presents the individual use assessments for the lakes in the Buzzards Bay Watershed.

Table 6. Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|--|-------|--------------|------------------------------------|--|---------------------------------------|---|----------------------------------|
| Abner Pond, Plymouth | 95001 | 10 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Pond used for recreation by boy scout camp. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Barrett Pond, Carver | 95004 | 16 | NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). Barrett Pond is within the Myles Standish State Forest and has a public bathing beach. <i>Enterococci</i> samples were collected weekly by MA DEM from 6/25/01 through 8/13/01 and 5/21/02 through 7/16/02. The beach was not formally posted and, therefore, the recreational uses are assessed as support. | | | | | | | |
| Bates Pond, Carver | 95007 | 20 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Big Rocky Pond, Plymouth | 95119 | 18 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Big Sandy Pond, Plymouth | 95011 | 135 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. There is a public boat launch (DFWELE 2 July 2002). Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Blackmore Reservoir, Wareham | 95015 | 46 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Buttonwood Park Pond, New Bedford | 95020 | 12 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Pond is located in Buttonwood Park Zoo. | | | | | | | |
| Cedar Dell Lake, Dartmouth | 95021 | 24 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Charge Pond, Plymouth | 95025 | 23 | NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). Charge Pond is within the Myles Standish State Forest and has a public bathing beach. <i>Enterococci</i> samples were collected weekly by MA DEM from 6/25/01 through 8/13/01 and 5/21/02 through 7/16/02. The beach was not formally posted and, therefore, the recreational uses are assessed as support. | | | | | | | |
| College Pond, Plymouth | 95030 | 53 | NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). College Pond is within the Myles Standish State Forest and has a public bathing beach. <i>Enterococci</i> samples were collected weekly by MA DEM from 6/25/01 through 8/13/01 and 5/21/02 through 7/16/02. The beach was not formally posted and, therefore, the recreational uses are assessed as support. | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|--|-------|--------------|--|-------------------------------------|------------------------------------|--------------------------------------|--------------------------------|
| Cornell Pond, Dartmouth | 95031 | 16 | NOT ASSESSED | IMPAIRED (Mercury, PCBs) | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Pond is accessible for recreation. Fish toxics monitoring conducted by DWM in 1988. MDPH issued a fish consumption advisory. Sources of PCB linked to the Resolve Superfund site- 16 (see details in summary of conditions and perceived problems and Copicut River segment MA95-43). | | | | | | | |
| Crane Brook Bog Pond, Carver | 95033 | 37 | IMPAIRED (Non-native plants) phosphate, excess algal growth) | NOT ASSESSED | IMPAIRED (Excess algal growth) | IMPAIRED (Excess algal growth) | IMPAIRED (Excess algal growth) |
| NOTE: Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) identified during the 2000 TMDL survey (Mattson 2003). The surface water was densely covered with aquatic macrophytes, duckweed and filamentous algae, indicating enrichment. Total phosphorus concentrations were elevated (i.e., ranging between 0.05 and 0.13 mg/L) in the pond as well as in the inlet (Appendix A). Dissolved oxygen was low on one of the two dates sampled (DO data censored from August 2000), however, it was not determined whether or not this was due to natural conditions or to anthropogenic sources. The low pH is considered natural. No public bathing beach. Suspected sources of impairment include highway/road runoff and irrigated, specialty crop production related to cranberry bogs. | | | | | | | |
| Curllew Pond, Plymouth | 95034 | 43 | NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). Curllew Pond is within the Myles Standish State Forest and has a public bathing beach. <i>Enterococci</i> samples were collected weekly by MA DEM from 6/25/01 through 8/13/01 and 5/21/02 through 7/16/02. The beach was not formally posted and, therefore, the recreational uses are assessed as support | | | | | | | |
| Deer Pond, Plymouth | 95036 | 11 | NOT ASSESSED* | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: <i>Myriophyllum</i> sp. noted during synoptic survey in 1995 needs confirmation so <i>Aquatic Life Use</i> is identified with Alert Status (Appendix A). No public bathing beach. Forested shoreline. | | | | | | | |
| Dicks Pond, Wareham | 95038 | 40 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 - <i>Myriophyllum</i> sp noted, not likely heterophyllum. Non-native plant (<i>Phragmites australis</i>) identified during the 1995 synoptic survey (Appendix A). No public bathing beach. | | | | | | | |
| Dunham Pond, Carver | 95044 | 45 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). There is a public bathing beach, but no sampling is currently conducted. | | | | | | | |
| East Head Pond, Carver/Plymouth | 95177 | 92 | NOT ASSESSED* | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: <i>Myriophyllum</i> sp. noted during synoptic survey in 1995 needs confirmation so <i>Aquatic Life Use</i> is identified with Alert Status (Appendix A). No public bathing beach. | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|---|-------|--------------|---------------------------------|-------------------------------------|------------------------------------|--------------------------------------|-------------------------------|
| Ezekiel Pond, Plymouth | 95051 | 36 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. Developed shoreline. | | | | | | | |
| Fawn Pond, Plymouth | 95053 | 33 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. Forested shoreline. | | | | | | | |
| Fearing Pond, Plymouth | 95054 | 24 | NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). Fearing Pond is within the Myles Standish State Forest and has a public bathing beach. <i>Enterococci</i> samples were collected weekly by MA DEM from 6/25/01 through 8/13/01 and 5/21/02 through 7/16/02. The beach was not formally posted and, therefore, the recreational uses are assessed as support. | | | | | | | |
| Federal Pond, Carver (also known as Federal Furnace Pond) | 95055 | 129 | IMPAIRED (Non-native plants) | NOT ASSESSED | IMPAIRED (Non-native plants) | IMPAIRED (Non-native plants) | IMPAIRED (Non-native plants) |
| NOTE: Non-native aquatic plants (<i>Cabomba caroliniana</i> and <i>Myriophyllum heterophyllum</i>) identified during the 2000 TMDL survey and the 1995 synoptic survey (Appendix A). <i>Lythrum salicaria</i> also noted during 2000 survey (Mattson 2003). DFWLE conducted a fish population survey in Federal Pond in 2000. Nine species were present and the assemblage was dominated by bluegill, largemouth bass and chain pickerel (Table 4.) The surface water was very densely covered with the non-native aquatic macrophyte <i>Cabomba caroliniana</i> . The total phosphorus concentrations were moderate ranging from 0.062 to 0.007 mg/L. There is no public bathing beach. | | | | | | | |
| Five Mile Pond, Plymouth | 95056 | 29 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Pond may be used by area residents for recreation. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Fresh Meadow Pond, Carver/Plymouth | 95174 | 59 | IMPAIRED (Non-native plants) | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Non-native aquatic plants (<i>Cabomba caroliniana</i> and likely <i>M. heterophyllum</i>) noted during 1995 synoptic survey (Appendix A). | | | | | | | |
| Gallows Pond, Plymouth | 95059 | 43 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Pond used for recreation by girl scout camp. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Glen Charlie Pond, Wareham (also known as Shangrila Pond) | 95061 | 185 | NOT ASSESSED* | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Glen Charlie Pond has a public bathing beach. <i>E. Coli</i> samples were collected by Barnstable County Labs every two weeks in 2000 and weekly in 2001. According to the Wareham Board of Health, Shangrila Beach was only closed between July 18-23, 1999 and, therefore, the <i>Recreational</i> uses are assessed as support. <i>M. sp.</i> noted during 1995 synoptic survey (Appendix A); suspect <i>M. heterophyllum</i> so <i>Aquatic Life Use</i> is identified with an Alert Status. Non-native wetland plant (<i>Phragmites australis</i>) identified during the 1995 synoptic survey (Appendix A). Fish toxics monitoring conducted in pond by DWM in 1995 but no advisory issued (Appendix B) | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|--|-------|--------------|---------------------------------|-------------------------------------|------------------------------------|--------------------------------------|-------------------------------|
| Halfway Pond, Plymouth | 95178 | 232 | NOT ASSESSED* | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Shoreline partially developed. <i>M. sp.</i> noted during 1995 synoptic survey (Appendix A). It is suspected to be <i>M. heterophyllum</i> , therefore, <i>Aquatic Life Use</i> is identified with an Alert Status. | | | | | | | |
| Horseshoe Pond, Wareham | 95075 | 85 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Kings Pond, Plymouth | 95078 | 21 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Developed shoreline. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Leonard's Pond, Rochester | 95080 | 54 | NOT ASSESSED* | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. <i>M. sp.</i> noted during 1995 synoptic survey (Appendix A). It is suspected to be <i>M. heterophyllum</i> , therefore, the <i>Aquatic Life Use</i> is identified with an Alert Status. | | | | | | | |
| Little Long Pond, Plymouth | 95088 | 45 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Little Long Pond, Wareham | 95089 | 19 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix X). | | | | | | | |
| Little Rocky Pond, Plymouth | 95091 | 11 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Developed shoreline. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Little Sandy Pond, Plymouth | 95092 | 29 | NOT ASSESSED* | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Developed shoreline. <i>M. sp.</i> noted during 1995 synoptic survey (Appendix A). It is suspected to be <i>M. heterophyllum</i> , therefore, the <i>Aquatic Life Use</i> is identified with an Alert Status. | | | | | | | |
| Little West Pond, Plymouth | 95093 | 25 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Pond may be used by campers for recreation. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Long Duck Pond, Plymouth | 95095 | 23 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Developed shoreline. Synoptic surveys in 1995 and 1996 (Appendix A). | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|--|-------|--------------|---------------------------------|-------------------------------------|------------------------------------|--------------------------------------|-------------------------------|
| Long Pond, Plymouth NOTE: No public bathing beach. Public boat launch. Synoptic survey in 1995 (Appendix A). | 95096 | 211 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| Long Pond, Rochester NOTE: No public bathing beach. In 1995 DWM sampled Snipatuit Pond which is connected to Long Pond (Appendix B). MDPH issued a fish consumption based on the data. | 95097 | 33 | NOT ASSESSED | IMPAIRED (Mercury) | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| Mare Pond, Plymouth NOTE: No public bathing beach. Pond may be used by area residents for recreation. Synoptic survey in 1995 (Appendix A). | 95172 | 12 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| Mary's Pond, Rochester NOTE: Mary's Pond has a private bathing beach owned by Perry's Camp. Testing is reported to the New Bedford Board of Health and Town Clerk. Information on beach closings not determined. Synoptic survey in 1995 (Appendix A). | 95100 | 81 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| Micajah Pond, Plymouth NOTE: No public bathing beach. Synoptic survey in 1995 <i>Myriophyllum</i> sp. Noted, but not likely heterophyllum (Appendix A). | 95102 | 20 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| Mill Pond, Wareham NOTE: No public bathing beach. Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) identified during the 1995 synoptic survey (Appendix A). | 95105 | 150 | IMPAIRED (Non-native plants) | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|--|-------|--------------|--|-------------------------------------|---|---|-------------------------------|
| New Bedford Reservoir, Acushnet | 95110 | 219 | IMPAIRED (Non-native plants, DO, DO saturation, phosphate) | NOT ASSESSED | IMPAIRED (Non-native plants, phosphate) | IMPAIRED (Non-native plants, phosphate) | IMPAIRED (Phosphate) |
| NOTE: No public bathing beach, however, there is public access via two boat ramps off of Lake Street. The outlet structure is managed to maintain flows in the Acushnet River necessary for herring migration (ENSR 2002). DMF recently completed renovations (totaling \$ 0.25 million) to the fishway at the outlet to New Bedford Reservoir (Brady 2003). MA DEM Lake and Pond Grant 2001 to develop watershed management plan to control nutrients and nuisance aquatic plants, D/F Study. Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) identified during the 2000 TMDL survey and the 1995 synoptic survey (Appendix A). ENSR (2002) documented direct runoff from Lake Street into all three basins of New Bedford Reservoir. DFWLE conducted fish population work in New Bedford Reservoir in 2000 (Table 5). | | | | | | | |
| New Bedford Reservoir (north basin) (146 acres): low dissolved oxygen/saturation levels and very dense cover of <i>Wolffia</i> , total phosphorus concentrations were moderate (0.021 to 0.07 mg/L). One inlet to the north basin (station R, unique ID 788) draining the cranberry bog at the western edge of the Reservoir had very high total phosphorus concentrations (Appendix A). It should be noted that approximately 80% of New Bedford Reservoir North basin biovolume (the 3-dimensional space available for biological growth) has dense/very dense vegetation. | | | | | | | |
| New Bedford Reservoir (south basin) (48 acres): dissolved oxygen/saturation levels were generally good and total phosphorus concentrations were low (ranging between 0.018 and 0.058 mg/L). One inlet to the south basin (station S, unique ID 789) draining the cranberry bog at the northeastern corner of the south basin had high total phosphorus concentrations (Appendix A). It should be noted that less than 10% of New Bedford Reservoir south basin biovolume has dense/very dense vegetation. | | | | | | | |
| New Bedford Reservoir (east basin) (25 acres): limited water quality data available for this basin of the reservoir (Appendix A). It should be noted that approximately 25% of New Bedford Reservoir east basin biovolume has dense/very dense vegetation. | | | | | | | |
| New Long Pond, Plymouth | 95112 | 23 | SUPPORT* | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | SUPPORT |
| NOTE: No public bathing beach. TMDL surveys conducted in 2000 (Appendix A). Physico-chemical data (low total phosphorus concentrations, good dissolved oxygen concentrations) indicated good water quality, however, due to very low pH and alkalinity the <i>Aquatic Life Use</i> is identified with an "Alert Status" (Appendix A). No objectionable conditions (trash debris, oil sheens, etc) were noted by DWM during the 2000 TMDL surveys. | | | | | | | |
| Noquochoke Lake, Dartmouth | 95113 | 110 | IMPAIRED (Non-native plants) | IMPAIRED (Mercury, PCBs) | IMPAIRED (Enterococci) | NOT ASSESSED | NOT ASSESSED |
| NOTE: Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) identified during the 1995 synoptic survey (Appendix A). Fish toxics monitoring conducted by DWM in 1988 and again in 2000 (Appendix B). MDPH issued a fish consumption advisory. Sources of PCB linked to the Resolve Superfund site- code 16 (see details in summary of conditions and perceived problems and Copcut River segment MA95-43). Noquochoke Lake has a public bathing beach. Noquochoke Lake was closed to swimming between 6/14 -7/2/2001 (estimated as 25% of the swimming season) due to elevated <i>Enterococci</i> levels (MDPH 2002b). MA DEM Lake and Pond Grant 1999 to prepare watershed management plan with long term remediation recommendations. | | | | | | | |
| Noquochoke Lake (East Basin), Dartmouth | 95170 | 17 | IMPAIRED (Non-native plants) | IMPAIRED (Mercury, PCBs) | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) identified during the 1995 synoptic survey (Appendix A). Fish toxics monitoring conducted by DWM in 1988 and again in 2000 (Appendix B). MDPH issued a fish consumption advisory. Sources of PCB linked to the Resolve Superfund site- code 16 (see details in summary of conditions and perceived problems and Copcut River segment MA95-43). MA DEM Lake and Pond Grant 1999 to prepare watershed management plan with long term remediation recommendations. | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|--|-------|--------------|---|-------------------------------------|---|---|---|
| Noquochoke Lake (North Basin), Dartmouth | 95171 | 19 | IMPAIRED (Non-native plants) | IMPAIRED (Mercury, PCBs) | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) identified during the 1995 synoptic survey (Appendix A). Fish toxics monitoring conducted by DWM in 1988 and again in 2000 (Appendix B). MDPH issued a fish consumption advisory. Sources of PCB linked to the Resolve Superfund site- code 16 (see details in summary of conditions and perceived problems and Copicut River segment MA95-43). MA DEM Lake and Pond Grant 1999 to prepare watershed management plan with long term remediation recommendations. | | | | | | | |
| Parker Mills Pond, Wareham | 95115 | 105 | IMPAIRED (Non-native plants, phosphate) | NOT ASSESSED | IMPAIRED (Non-native plants, phosphate) | IMPAIRED (Non-native plants, phosphate) | IMPAIRED (Non-native plants, phosphate) |
| NOTE: No public bathing beach. Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) was identified during the 1995 synoptic survey (Appendix A) but not noted on the 2000 TMDL survey field sheets. Non-native plant (<i>Phragmites australis</i>) also identified during the 2000 synoptic survey (Mattson 2003). DFWLE conducted a fish population survey in Parker Mills Pond in 2000. Ten species were present and the assemblage was dominated by golden shiner, largemouth bass, and bluegill (Table 4.) The northern two-thirds of the pond surface water was very densely covered with <i>Lemna</i> , <i>Wolffia</i> , and <i>Ceratophyllum</i> . The total phosphorus concentrations were moderate to high ranging from 0.03 to 0.098 mg/L. One inlet (station B, unique ID 777) from a cranberry bog on the western edge of the southern end had very high total phosphorus concentrations (ranging from 0.10 to 2.5 mg/L – Appendix A). Dissolved oxygen data were very limited (Appendix A). Suspected sources of impairment include highway/road runoff and irrigated, specialty crop production related to cranberry bogs. | | | | | | | |
| Queen Sewell Pond, Bourne | 95180 | 18 | NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Queen Sewell Pond has a public bathing beach. <i>E. coli</i> samples were collected every two weeks in 2001 and weekly in 2002 by Bourne Health Dept. The beach has not been closed and, therefore, the <i>Recreational</i> uses are assessed as support. Information on beach closings is not determined. | | | | | | | |
| Rocky Meadow Brook Pond, Carver | 95118 | 11 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Rocky Pond, Plymouth | 95179 | 18 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach, developed shoreline. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Round Pond, Plymouth | 95123 | 10 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: No public bathing beach. Synoptic survey in 1995 (Appendix A). | | | | | | | |
| Sampson Pond, Carver | 95125 | 310 | IMPAIRED (Non-native plants) | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Non-native aquatic plant (<i>Cabomba caroliniana</i>) identified during the 1995 synoptic survey (Appendix A). Sampson Pond has a public bathing beach. <i>E. coli</i> samples were collected by the Carver Board of Health roughly every three weeks from 5/24/01 through 9/12/01 (n=9). According to the Carver Board of Health the beach has never been closed and, therefore, the <i>Recreational</i> Uses are assessed as support. | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|---|-------|--------------|---------------------------------|-------------------------------------|------------------------------------|--------------------------------------|-------------------------------|
| Sand Pond, Wareham | 95127 | 15 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Class A public water supply. Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Sandy Pond, Wareham | 95128 | 18 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Snipatuit Pond, Rochester | 95137 | 644 | NOT ASSESSED | IMPAIRED (Mercury) | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: In 1995 DWM sampled Snipatuit Pond, which is connected to Long Pond (Appendix B). MDPH issued a fish consumption based on the data. Snipatuit Pond has a public access site (a public boat launch) and a bathing beach owned by a neighborhood association. In 2002, the beach was closed for two days out of the 10 weeks it was open (New Bedford Board of Health 2002). Based on this information, the <i>Recreational Uses</i> are assessed as support. | | | | | | | |
| South Meadow Brook Pond, Carver | 95139 | 25 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| South Meadow Pond, Carver | 95140 | 17 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Southwest Atwood Bog Pond, Carver | 95141 | 14 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Spectacle Pond, Wareham | 95142 | 42 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Three Cornered Pond, Plymouth | 95145 | 14 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Tihonet Pond, Wareham | 95146 | 89 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Tinkham Pond, Mattapoisett/Acushnet | 95148 | 20 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). Non-native wetland plant (<i>Phragmites australis</i>) noted below outlet control structure. No public bathing beach. | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|--|-------|--------------|---|-------------------------------------|---|---|---|
| Tremont Mill Pond, Wareham | 95150 | 50 | IMPAIRED (Non-native plants) | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Non-native aquatic plant (<i>Myriophyllum heterophyllum</i>) identified during the 1995 synoptic survey (Appendix A). No public bathing beach. | | | | | | | |
| Turner Pond, New Bedford/Dartmouth | 95151 | 86 | SUPPORT* | IMPAIRED (Mercury) | NOT ASSESSED | NOT ASSESSED | SUPPORT |
| NOTE: TMDL survey conducted in 2000 and synoptic survey in 1995. This pond had low dissolved oxygen/saturation at depths below 1.5m, very low pH, and high color (Appendix A). These data are likely indicative of natural conditions associated with the large wetland complex directly upstream. While there are moderate levels of total phosphorus at the surface (concentrations ranging between 0.024 to 0.057mg/L) and high concentrations near the lake bottom (ranging from 0.041 to 0.29 mg/L) they did not result in high lake productivity (i.e., plant community indicative of wetland conditions). Biovolume density estimated as 30% dense/very dense cover and no non-native plants were identified (Mattson 2003). The <i>Aquatic Life Use</i> is assessed as support, however, it is also identified with an Alert Status because it is uncertain if the phosphorus concentrations are elevated as a result of road runoff or other anthropogenic sources. Fish Toxics Monitoring was conducted by DWM in 1988 as part of a Paskamanset River survey. Two of four samples had elevated levels of total mercury in black crapple. There is no public bathing beach on Turner Pond. The Secchi disc depths taken as part of the 2000 TMDL survey do not meet the bathing beach guidelines, however, it is best professional judgment that these conditions are naturally occurring (a result of the highly colored water). No fecal coliform bacteria data are available and, therefore, the <i>Primary</i> and <i>Secondary Contact Recreational</i> uses are currently not assessed. | | | | | | | |
| Union Pond, Wareham | 95152 | 25 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |
| Vaughn Pond, Carver (also known as Crystal Lake) | 95153 | 22 | NOT ASSESSED | NOT ASSESSED | SUPPORT | SUPPORT | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). Vaughn Pond has a public bathing beach. <i>E. coli</i> samples were collected by Carver Board in 2001 and 2002. According to the Carver Board of Health the beach has never been closed and, therefore, the <i>Recreational Uses</i> are assessed as support. MA DEM Lake and Pond Grant 1999 septic system management shorefront properties. | | | | | | | |
| White Island Pond (East Basin), Plymouth | 95166 | 159 | IMPAIRED (Non-native plants, phosphate, excess algal growth, chlorophyll a) | NOT ASSESSED | IMPAIRED (Excess algal growth, Secchi disk transparency, phosphate) | IMPAIRED (Excess algal growth, Secchi disk transparency, phosphate) | IMPAIRED (Excess algal growth, Secchi disk transparency, phosphate) |
| NOTE: Non-native aquatic plant (<i>Cabomba caroliniana</i>) identified during the 2000 TMDL survey (Mattson 2003). <i>Lythrum salicaria</i> also noted during 2000 survey (Appendix A). Although dissolved oxygen concentrations met criteria, supersaturation was evident during the August and September surveys (100 to 105%). Chlorophyll a concentrations were also high (35 mg/m ³). Elevated in-lake total phosphorus concentrations (ranging from 0.077 to 0.12 mg/L) as well as from several inlets to the pond draining cranberry bogs (0.066 to 1.4 mg/L) (Appendix A). Fish toxics monitoring conducted by DWM (station F0108) in 2000 (Appendix B). No advisory was issued by MDPH. Secchi disk depth measurements were at or below 1.2 m (the bathing beach guideline) on all three sampling dates. Low biovolume density may be associated with phytoplankton dominance (field observations indicated phytoplankton blooms). Suspected sources of impairment include irrigated, specialty crop production related to cranberry bogs and on-site treatment systems (septic systems). | | | | | | | |

Table 6 (Continued). Buzzards Bay Watershed Lake Use Assessments.

| Lake, Location | WBID | Size (Acres) | Aquatic Life (Impairment Cause) | Fish Consumption (Impairment Cause) | Primary Contact (Impairment Cause) | Secondary Contact (Impairment Cause) | Aesthetics (Impairment Cause) |
|---|-------|--------------|---------------------------------|-------------------------------------|------------------------------------|--------------------------------------|-------------------------------|
| White Island Pond (West Basin), Plymouth | 95173 | 125 | IMPAIRED (Non-native plants) | NOT ASSESSED | NOT ASSESSED* | NOT ASSESSED* | NOT ASSESSED* |
| NOTE: Non-native aquatic plant (<i>Cabomba caroliniana</i>) identified during the 2000 TMDL survey and the 1995 synoptic survey (Appendix A). <i>Lythrum salicaria</i> and <i>Phragmites australis</i> also noted during 2000 survey (Mattison 2003). Although dissolved oxygen concentrations met criteria, supersaturation was evident during the September survey (104 to 106%). Chlorophyll <i>a</i> concentrations were moderate (5.7 – 13.1 mg/m ³) and in-lake total phosphorus concentrations ranged from 0.037 to 0.076 mg/L (Appendix A). Fish toxics monitoring conducted by DWM (station F0114) in 2000 (Appendix B). No advisory was issued by MDPH. Secchi disk depth measurements were above 1.2 m (the bathing beach guideline) on all three sampling dates. The biovolume density was very low and may be associated with phytoplankton dominance (field observations indicated phytoplankton blooms and filamentous algae). No public bathing beach. Pond may be used by area residents for recreation. No fecal coliform bacteria data are available, therefore, the <i>Recreational</i> and <i>Aesthetic</i> uses are currently not assessed. However, these uses are identified with an Alert Status because of the noted phytoplankton bloom. Suspected sources include on-site treatment systems (septic systems). | | | | | | | |
| Whites Pond, Plymouth | 95168 | 33 | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED | NOT ASSESSED |
| NOTE: Synoptic survey in 1995 (Appendix A). No public bathing beach. | | | | | | | |

RECOMMENDATIONS – LAKES

- Coordinate with MA DEM and/or other groups that conduct lake surveys to generate quality-assured lake data. Conduct more intensive lake surveys to better determine the lake trophic and use support status and identify causes and sources of impairment. As sources are identified within lake watersheds they should be eliminated or, at least, minimized through the application of appropriate point or non-point source control techniques.
- Work with the Six Ponds Improvement Association to complete their Quality Assurance Project Plan. Review data collected under their approved QAPP for use in future assessments.
- Work with MDPH and local municipalities to collect quality-assured data under the “Beaches Bill,” which requires water quality testing (bacteria sampling) at all formal bathing beaches. When available, review data and beach closure information to assess the status of the recreational uses.
- Review the MA DEP Drinking Water Program SWAP evaluations are when they are completed to develop and implement recommendations for the protection of Class A lakes in the Buzzards Bay Watershed, including Sand Pond, Wareham.
- Work with the MA DEM Weed Watchers Program to monitor ponds in the Buzzards Bay Watershed for the presence of exotic invasive species and to develop a removal plan if an infestation is found. Additional information may be obtained from the MA DEM website:
<http://www.state.ma.us/dem/programs/lakepond/weedwatch.htm>.
- Quick action is necessary to manage non-native aquatic or wetland plant species that are isolated in one or a few location(s) in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations (Figure 17 and Table 6), to determine the extent of the infestation. And, “spot” treatments (refer to the draft Generic Environmental Impact Report (GEIR) for Eutrophication and Aquatic Plant Management in Massachusetts [Mattson *et al* 1998] for advantages and disadvantages of each) should be undertaken to control populations at these sites. These treatments may include careful hand-pulling of individual plants in small areas. In larger areas, other techniques, such as selective herbicide application, may be necessary. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These actions will minimize the spreading of the populations. This draft GEIR (Mattson *et al* 1998) should be consulted prior to the development of any lake management plan to control non-native aquatic or wetland plant species.
- Where non-native plant infestations are more extensive conduct additional monitoring to determine the extent of the problem. The draft Generic Environmental Impact Report for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al* 1998) should be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (i.e., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should be discouraged because of the propensity for some invasive species of these plants to reproduce and spread vegetatively (from cuttings).
- Confirm the presence of *Myriophyllum heterophyllum*, which is suspected to occur in East Head Pond and Fresh Meadow Pond, both in Carver/Plymouth. At the time of the DWM survey in 1995 these plants were not adequately developed to precisely identify them as *M. heterophyllum*.
- Prevent spreading of invasive plants. Once the extent of the problem is determined and control practices are exercised vigilant monitoring needs to be practiced to guard against infestations in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the transport mechanisms and their ability/responsibility to reduce the spread of these species.

- Implement recommendations identified in TMDLs and lake Diagnostic/Feasibility studies, including lake watershed surveys, to identify sources of impairment. The single draft TMDL report for total phosphorus, which is being developed for the eight lakes sampled by DWM in 2000, has been delayed until the *Cranberry Bog Phosphorus Dynamics TMDL Project* (DeMoranville 2001) has been completed (Mattson 2002).

LITERATURE CITED

- Ackerman, M.T. 1989. *Compilation of Lakes, Ponds, Reservoirs and Impoundments Relative to the Massachusetts Lake Classification Program*. Publication: #15901-171-50-4-89-c.r. Technical Services Branch, Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering. Westborough, MA.
- ACOE. 1995. *Massachusetts Water Resources Development- Flood Damage Reduction, Shore & Bank Protection, Navigation*. Report publication NEDEP-360-1-34. US Army Corps of Engineers New England District, Concord, MA.
- ACOE. 31 January 2002. [Online]. *Update Report for Massachusetts*. U.S. Army Corps of Engineers, New England District. <http://www.nae.usace.army.mil>.
- AFCEE. 2001. [Online] *Landfill 1 Groundwater Plume Update*. Fact Sheet #2001-04. Massachusetts Military Reservation, Bourne, MA. Air Force Center for Environmental Excellence <http://www.mmr.org/Cleanup/index.htm>
- ASA. 2002a. *Improving New Bedford's Waters* in *Marine Environmental Newsletter* Vol. 16, No.2, April 2002. Applied Science Associates, Inc. Narragansett, Rhode Island.
- ASA. 2002b. *Flushing Analysis in the Acushnet River Estuary*. ASA Report 01-123 July 2002. Prepared for New England Interstate Water Pollution Control Commission. Applied Science Associates, Inc. Narragansett, Rhode Island.
- ASTM. 1991. *Guide for Conducting 10-Day Static Sediment Toxicity Tests With Marine And Estuarine Amphipods. ASTM Standard Methods Volume 1104, Method Number E-1367-90*. American Society for Testing and Materials, Philadelphia, PA.
- Barnstable County Department of Health 2003. [Online] *Summer 2002 Public Beach Water Quality Information*. <http://www.barnstablecountyhealth.org>
- BBP. August 1991. *Buzzards Bay Comprehensive Conservation and Management Plan Vol. 1 Management Recommendations and Action Plans*. Buzzards Bay Project, US Environmental Protection Agency, and Massachusetts Executive Office of Environmental Affairs, Marion, Massachusetts
- BBP. 1996-2000. *Buttermilk Bay Storm water Remediation Project 1996-2000*. Prepared by the Buzzards Bay Project/Town of Bourne for Massachusetts Department of Environmental Protection Bureau of Resource Protection and U. S. Environmental Protection Agency Region 1, East Wareham, MA
- BBP. 1997-2001. *Protecting Nitrogen Sensitive Embayments Through Land Conservation: A Demonstration in Two Buzzards Bay Embayments Project Number: 97-07/319*. Prepared by the Buzzards Bay Project for Massachusetts Department of Environmental Protection Bureau of Resource Protection and U. S. Environmental Protection Agency Region 1, East Wareham, MA
- BBP. 1999-2002. *Winsegauss Salt Marsh Restoration Project Number: 99-04/319*. Prepared by the Buzzards Bay Project and the Town of Fairhaven for Massachusetts Department of Environmental Protection Bureau of Resource Protection and U. S. Environmental Protection Agency Region 1, East Wareham, MA
- BBP. 2002a. *Restoring the Herring to Adamsville Pond, Westport, MA* The Buzzards Bay Project National Estuary Program, East Wareham, MA
- BBP. 2002b. *Atlas of Tidally Restricted Salt Marshes in the Buzzards Bay Watersheds Massachusetts*. The Buzzards Bay Project National Estuary Program, East Wareham, MA
- BBP. Undated. [Online] *Pumpouts in Buzzards Bay*. Buzzards Bay Project National Estuary Program, East Wareham, MA. <http://www.buzzardsbay.org/pumpouts.htm>
- Bent, G. C. 1995. *The Streamflow, Ground-Water Recharge And Discharge, And Characteristics Of Surficial Deposits In Buzzards Bay Basin, Southeastern Massachusetts* US Geological Survey Water-Resources Investigations Report 95-4234 United States Geological Survey, Marlborough, MA
- Brady, P. 2003. *Buzzards Bay Watershed Fish Passage Information*. Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries, Pocasset, MA. Personal Communication to Katie O'Brien Massachusetts Department of Environmental Protection, Division of Watershed Management.

- Brander, K. (Kevin.Brande@state.ma.us). 2002. *Buzzards Bay CSO Information*. Department of Environmental Protection, Northeast Regional Office, Wilmington. E-mail to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management dated 21 November 2002.
- Burns, D. (David.Burns@state.ma.us) 2003. NPDES permitting information for facilities in the Buzzards Bay Watershed. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Lakeville, MA. Emails to Katie O'Brien Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
- Cape Cod Commission, 1998. [Online] *Cape Cod Coastal Embayment Project, Project Overview Excerpted from the Interim Final Report*. <http://www.vsa.cape.com/~cccom/water/overview.htm> Cape Cod Commission. Barnstable, MA 1998.
- Carvalho-Souza, R. (roberta_in_ri@yahoo.com) 2002. *WRWA 2001 Data*. Westport River Watershed Alliance. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management dated 25 July 2002.
- Cataldo, C. 2003. Personal Communication. *FERC-Exempt Facilities in the Buzzards Bay Watershed--Town of Wareham, Tremont Dam*. Federal Energy Regulatory Commission (FERC) New York, NY. 8 January 2003.
- CBB Undated a. [Online] *The Coalition for Buzzards Bay Homepage. Bay Info*. <http://www.savebuzzardsbay.org/> The Coalition for Buzzards Bay. New Bedford, MA. 8 May 2003.
- CBB Undated b. *Baywatchers III: Nutrient-Related Health of Buzzards Bay Embayments 1992-2001* The Coalition for Buzzards Bay. New Bedford, MA.
- CDM. 1990. *City of New Bedford Facilities Plan*. Camp Dresser and McKee, Cambridge, MA
- CDM. 2000. *Water Quality Investigation of the Wareham River Estuary Complex DRAFT Report June 2000*. Camp Dresser & McKee, Cambridge, MA
- CDM. 2001a. *Town of Wareham Wastewater Facilities Plan Environmental Notification Form*. July 001. Camp Dresser & McKee, Cambridge, MA
- CDM. 2001b. *Town of Wareham, Massachusetts Comprehensive Wastewater Management Plan/Single Environmental Impact Report*. October 2001. Camp Dresser & McKee, Cambridge, MA
- Cohen, R. 2003. (Russ.Cohen@state.ma.us) *Buzzards Bay Watershed Year 2000 Water Quality Assessment Review Comments*. Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Riverways Program, Boston, MA. Email to Andrea Langhauser, Massachusetts Department of Environmental Protection, Division of Watershed Management, dated 13 June 2003.
- Coles, J.C. 1998. *Organochlorine Compounds in Fish Tissue from the Connecticut, Housatonic and Thames River Basins Study Unit, 1992-94*. National Water-Quality Assessment Program. U.S. Department of the Interior, U.S. Geological Survey. Marlborough, MA.
- Costello, C. 2003. *Mapping Eelgrass in Massachusetts, 1993-2003* Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Boston, MA.
- Dartmouth BOH. 2003. *Bacteria Data from Town Bathing Beaches*. Personal Communication from the Dartmouth Board of Health to Andrea Langhauser, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
- DeMoranville, C. 2001. *Cranberry Bog Phosphorus Dynamics TMDL Project - DEP 319 Project 01-12/319*. Awarded to University of Massachusetts Cranberry Experiment Station. East Wareham, MA.
- Desimone, L., P.A. Steeves, and M. J. Zimmerman. 2001. *Statewide Water-Quality Network for Massachusetts Water Resources Investigations Report 01-4081*. United States Geological Survey. Northborough. MA
- DFWELE. 1997. *Anadromous Fish Datalayer - March 1997*. Published by MassGIS (MA Office of Geographic and Environmental Information), Executive Office of Environmental Affairs, Department of Fisheries, Wildlife, and Environmental Law Enforcement. Boston, MA.

DFWELE. 2000. *Designated Shellfish Growing Areas Datalayer – July 2000*. Published by MassGIS (MA Office of Geographic and Environmental Information), Executive Office of Environmental Affairs, Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries. Boston, MA.

DFWELE. 2 July 2002. *Public Access Board information*. MA Department of Fisheries, Wildlife, and Environmental Law Enforcement. [Online] http://www.state.ma.us/dfwele/PAB/pab_table2.htm.

DFWELE. 24 September 2002. *Massachusetts Trout Stocked Waters – 2002*. [Online]. Department of Fisheries, Wildlife, and Environmental Law Enforcement, Mass Wildlife. <http://www.state.ma.us/dfwele/dfw/dfwtroutwat02.htm#SOUTH>. 16 May 2002.

DFWELE. December 2002. *Low Flow Inventory Buzzards Bay Basin*. MA Department of Fisheries, Wildlife, and Environmental Law Enforcement. [Online] http://www.state.ma.us/dfwele/river/rivLow_Flow_Inventory/buzzardsbay.html 10 July 2003.

DMF. 1999. *Sanitary Survey of New Bedford/Fairhaven Inner Harbor in the City of New Bedford and the Town of Fairhaven BB15.1 July 1999*. David Whittaker, Marine Fisheries Biologist, Massachusetts Division of Marine Fisheries, Pocasset, MA.

DMF. 29 January 2003. *Clean Vessel Act/ Boating Infrastructure Grant Programs Pumpout Stations Southeast Wareham to Seekonk* [Online] Massachusetts Division of Marine Fisheries. <http://www.state.ma.us/dfwele/dmf/programsandprojects/pumpout.htm#pumpout> 31 January 2003.

DNRT. 2003. *Paskamanset River/Destruction Brook Fish Passage Information*. Dartmouth Resources Natural Trust. Personal communication with Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Dowden, Holly, 2003. [hdowden@cape.com] Barnstable County Department of Health. *Summer 2001 Public Beach Water Quality Information for Falmouth and Bourne*. E-mail to Andrea Langhauser, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 13 May 2003.

Drake, J (Janice.Drake@state.ma.us) . 2003. *Comments on the Draft Buzzards Bay Water Quality Assessment Report*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Lakeville, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 25 June 2003.

ENSR. 2002. *Diagnostic/Feasibility Study of New Bedford Reservoir, Acushnet, Massachusetts. Dec. 2002*. Document Number 8734-675. ENSR International, Westford, MA.

Environment Canada. 04 November 1999. *Canadian Environmental Quality Guidelines*. [Online]. Environment Canada. http://www.ec.gc.ca/ceqg-rcqe/tistbl_e.doc [28 September 1998].

Environmental Law Reporter. 1988. *Clean Water Deskbook*. Environmental Law Institute. Washington, D.C.

EPA. 1995. *Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuarines, Volume 1: Biological and Physical Analyses*. U.S. Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/620/R-95/008.

EPA. 1997. *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates: Report Contents*. US Environmental Protection Agency, Assessment and Watershed Protection Division (4503f). Office of Wetlands, Oceans and Watersheds. Office of Water. Washington D.C.

EPA. 19 November 1999. *Federal Register Document*. [Online]. United States Environmental Protection Agency. <http://www.epa.gov/fedrgstr/EPA-WATER/1998/December/Day-10/w30272.htm>.

EPA. 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia*. U.S. Environmental Protection Agency, Office of Water and Office of Science and Technology. Washington, D.C. and Office of Research and Development, Duluth, MN.

EPA. May 2002. [Online] *National Listing of Fish and Wildlife Consumption Advisories*. U.S. Environmental Protection Agency, Office of Science and Technology. <http://map1.epa.gov/> 11 March 2003.

EPA. 25 June 2002. [Online] *Storm Water Phase II Final Rule Fact Sheet Series*. U.S. Environmental Protection Agency, Office of Water <http://cfpub.epa.gov/npdes/stormwater/swfinal.cfm>

- EPA. 13 December 2002a. [Online] *EPA New England National Priorities List (NPL) Fact Sheets: Atlas Tack Corp. Fairhaven, MA.*
http://yosemite.epa.gov/r1/npl_pad.nsf/fe76f28619343bf185256ac600507c5e/7f21321a3a6f9c90852568ff005adb0c?OpenDocument 13 February 2003.
- EPA. 13 December 2002b. [Online] *EPA New England National Priorities List (NPL) Fact Sheet Re-Solve Inc., North Dartmouth, MA*
http://yosemite.epa.gov/r1/npl_pad.nsf/f6ec47ff9443008f85256aca004f000f/904132284a8a1e5a8525691f0063f6ef?OpenDocument 13 February 2003.
- EPA. 13 December 2002c. [Online] *EPA New England National Priorities List (NPL) Fact Sheet Sullivan's Ledge, New Bedford, MA*
http://yosemite.epa.gov/r1/npl_pad.nsf/f6ec47ff9443008f85256aca004f000f/e704d6c17f74ea678525697b0008ccaa?OpenDocument 13 February 2003.
- EPA. 13 December 2002d. [Online] *EPA New England National Priorities List (NPL) Fact Sheets: Otis Air National Guard Base/Camp Edwards. Falmouth, Bourne, Sandwich, and Mashpee, MA.*
http://yosemite.epa.gov/r1/npl_pad.nsf/51dc4f173ceef51d85256adf004c7ec8/efabe4bc615b22288525692d0061823f?OpenDocument 13 February 2003.
- EPA 31 December 2002. [Online] *Broad Marsh River Storm Water Remediation Project: Infiltration Structures Reduce Pollutants, Save Shellfish Beds.* <http://www.epa.gov/owow/nps/Section319III/MA.htm>). United States Environmental Protection Agency. Office of Wetlands, Oceans, and Watersheds, Washington, D.C. 15 May 2003
- EPA. 2002. *Consolidated Assessment and Listing Methodology – toward a compendium of best practices.* United States Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds. Washington, DC.
- EPA. 13 February 2003. [Online] New England New Bedford Harbor Site <http://www.epa.gov/ne/nbh/index.html> 13 February 2003.
- EPA. 29 July 2003. [Online] *Record of Decision System New Bedford Record of Decision List*
<http://cfpub.epa.gov/superrods/rodslist.cfm?msiteid=0100743> United States Environmental Protection Agency. Office of Solid Waste and Emergency Response, Washington, D.C. 13 November 2003.
- ESS. 2003. *Westport River Watershed Bacteriological Non-Point Source Assessment Town of Westport, Massachusetts 2001-2002 Project No. 01-02/MWI.* ESS Project No. M247-000 January 10, 2003. Environmental Science Services, Inc. Wellesley, MA.
- FERC. 26 July 2001. *Federal Energy Regulatory Commission Environmental Inspection Report New York Region Tremont Dam Project NO. 3894-MA.* 26 July 2001 by Joseph Enrico, Environmental Protection Specialist. [Online] <http://ferris.ferc.gov> [NOTE: To retrieve the document, enter "Tremont" in the search engine on the noted website.]
- Fiorentino, J. 2000. *Qualitative benthos assessment upstream and downstream of Marion WWTP.* Unpublished Memorandum to Dave Pincumbe, US EPA, Region 1, New England, Boston, MA. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
- Furtado, V. 2003. (VinF@CI.NEW-BEDFORD.MA.US) City of New Bedford, Massachusetts. Emails to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 28 April 2003 and 14 May 2003.
- Gould, Jeffrey E. 1998. Water Quality Certificate to B. Meunier, City of New Bedford Park Department. *In the matter of Buttonwood Park Zoo, Major Project Certification. Transmittal Number 121209.* MA DEP, Southeast Regional Office, Lakeville, MA.
- Goggins, Charles. 2001. Personal Communication. *FERC licensed facilities in the French and Quinebaug watersheds.* Federal Energy Regulatory Commission (FERC), New York. 25 October 2001.
- Greenway, M. 2003. *Old Rochester Regional School District NPDES Information.* Old Rochester Regional School District, Mattapoisett, MA. Personal Communication to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Grubbs, G.H. and R.H. Wayland III. 2000. Letter to Colleague dated 24 October 2000. *EPA recommendations on the use of fish and shellfish consumption advisories and certain shellfish growing area classifications in determining attainment of water quality standards and listing impaired waterbodies under section 303(d) of the Clean Water Act*. United States Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds. Washington, DC.

Halliwell, D.B., W.A. Kimball and A. J. Screpetis, 1982. *Massachusetts Stream Classification Program Part I: Inventory of Rivers and Streams*. Massachusetts Division of Fisheries and Wildlife, Department of Fisheries, Wildlife, and Recreational Vehicles and Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering. Westborough, MA.

Harding, S. 2003. *Certified Vernal Pool Information* Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Natural Heritage and Endangered Species Program, Westborough, MA

Hartley, R. 2003. *Fish Population Data Collected for Lakes Survey for TMDL Development* Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Fisheries and Wildlife, Westborough, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 28 February 2003.

Hogan, P.H. 2003. Personal Communication. *Buzzards Bay Watershed: permitting information*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management. Worcester, MA.

Howes, B. L., T. Williams, and M. Rasmussen. 1999. *Baywatchers II: Nutrient related water quality of Buzzards Bay embayments: a synthesis of Baywatchers monitoring 1992-1998*. The Coalition for Buzzards Bay. 150 pp. New Bedford, MA

Howes, B.L., D. White, R. Samimy, and M. Rappacz. 2002. The Massachusetts Estuaries Project Embayment Water Quality Assessment Interim Report Priority Embayments 1-20. University of Massachusetts-Dartmouth, School of Science and Technology, Dartmouth, MA

Howes, B.L., J. S. Ramsey, and S. W. Kelley. Undated. *Nitrogen Modeling to Support Watershed Management: Comparison of Approaches and Sensitivity Analysis Project Period October 2000-October 2001 Project Number:00-06/104* [Online] <http://www.state.ma.us/dep/smerp/smerp.htm> School for Marine Science and Technology, Coastal Systems Program, University of Massachusetts, Dartmouth, MA.

Howes, B.L. and R. Samimy. Undated. *Acushnet River TMDL Surface Water Flow and Nitrogen Load: Nitrogen Loading to New Bedford Inner Harbor* School for Marine Science and Technology, Coastal Systems Program, University of Massachusetts, Dartmouth, MA.

Hurley, S. (steve.hurley@state.ma.us) *Buzzards Bay Watershed Fish Population Data* Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Fisheries and Wildlife, Southeast District, Buzzards Bay, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 14 February 2003.

Jachec, J.M. and R.P. Hamilton Jr. 1999. *Flushing Characteristics of the Red Brook & Megansett Harbor System: Field Measurements and Numerical Modeling*. Woods Hole Group, Falmouth (Woods Hole), MA.

Janik, David. 2003. Personal Communication. *Buzzards Bay Watershed Team Priority Issues*. Massachusetts Executive Office of Environmental Affairs. March- April 2003.

Kennedy, J. (jeff.kennedy@state.ma.us). 2001. *Sanitary Survey Database Printout*. Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement. Division of Marine Fisheries, Shellfish Management Program. Newburyport, MA. E-mail to Stella Kiras, MA DEP DWM, dated 23 August 2001

Krahforst, C. 2000. *Quality Assurance Project Plan Massachusetts Estuarine Assessment Project October 2000 Project No. MMRP00-03*. Marine Monitoring and Research Program, Massachusetts Office of Coastal Zone Management, Executive Office of Environmental Affairs, Boston, MA.

Krahforst, C. 2003. (Christian.krahforst@state.ma.us) *Coastal 2000 Project Information*. Marine Monitoring and Research Program, Massachusetts Office of Coastal Zone Management, Executive Office of Environmental Affairs, Boston, MA. Emails to Katie O'Brien Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 24 March 2003.

LeVangie, D. 2002. *Water withdrawal registration and permit information*. Water Management Act Database. Massachusetts Department of Environmental Protection, Division of Watershed Management, Database Manager. Boston, MA.

Lloyd Center. 2001. [Online] *The Lloyd Center for Environmental Studies Home page*. <http://www.thelloydcenter.org>

Lotic, Inc. 1998. *The Massachusetts Pilot Study on Numeric Biocriteria for Stream and Small Rivers 1996 Data on Macroinvertebrates*. Lotic Inc. Environmental Consultants. Unity, Maine.

MA DEM. 1993. *Areas of Critical Environmental Concern (ACEC) Program Guide June 1993*. Commonwealth of Massachusetts, Executive Office of Environmental Affairs, Department of Environmental Management, ACEC Program. Boston, MA.

MA DEM. 2002. *Region 1 (southeast) beach bacteria data* Email from Robert Grahn (Robert.Grahn@state.ma.us), Massachusetts Department of Environmental Management, Office of Forests and Parks, South Carver, MA to Laurie Kennedy, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 4 December 2002.

MA DEM March 2003. *Areas of Critical Environmental Concern Listing and Index*. [Online] <http://www.state.ma.us/dem/programs/acec/acecs.htm> Commonwealth of Massachusetts. Executive Office of Environmental Affairs. Department of Environmental Management. ACEC Program. Boston, MA. 8 May 2003

MA DEM. Undated a. *Fort Phoenix State Reservation*. [Online] <http://www.state.ma.us/dem/parks/ftph.htm> MassParks, Massachusetts Department of Environmental Management, Boston, MA

MA DEM. Undated b. *Horseneck Beach State Reservation*. [Online] <http://www.state.ma.us/dem/parks/hbch.htm> MassParks, Massachusetts Department of Environmental Management, Boston, MA

MA DEM. Undated c. *Myles Standish State Forest*. [Online] <http://www.state.ma.us/dem/parks/mssf.htm> MassParks, Massachusetts Department of Environmental Management, Boston, MA

MA DEM. Undated d. *Scusset Beach State Reservation*. [Online] <http://www.state.ma.us/dem/parks/scus.htm> MassParks, Massachusetts Department of Environmental Management, Boston, MA

MA DEM. Undated e. *Demarest Lloyd State Park*. [Online] <http://www.state.ma.us/dem/parks/deml.htm> MassParks, Massachusetts Department of Environmental Management, Boston, MA

MA DEP. 1995. Open File. *OWM Buzzards Bay Watershed Lake Synoptic Survey Field Sheets*. Massachusetts surface water quality standards. Massachusetts Department of Environmental Protection, Office of Watershed Management. Grafton, MA.

MA DEP. 1996a. (Revision of 1995 report). *Massachusetts Surface Water Quality Standards*. Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch. Westborough, MA. 114p. (Revision of 314 CMR 4.00, effective June 23, 1996.)

MA DEP. 1996b. *Open Numeric Biocriteria Development Project Files*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 1999. *Final Massachusetts Section 303(d) List of Waters 1998*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP 2002a. *The Estuaries Project -- Addendum to Draft Massachusetts 2002 Integrated List of Waters. Part 2- Proposed Listing of Individual Categories of Waters*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 2002b. *Open NPDES permit files*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 2002c. *Open WMA permit files*. Massachusetts Department of Environmental Protection, Southeast Regional Office. Lakeville, MA.

MA DEP. 2002d. Open File. *PALIS updates*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MA DEP. 2003. *Publications of the Division of Watershed Management 1963-2002*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Watershed Planning Program. Worcester, MA.

MA DEP BWP. 2000. DEP Solid Waste Facilities. MassGis Datalayer June 2000 [Online]
<http://www.state.ma.us/mgis/sw/htm> Massachusetts Department of Environmental Protection Bureau of Waste Prevention, Boston, MA

MA EOEA. 2003. *Final Draft EOEA Cape Cod Watershed Assessment and Five Year Action Plan*. Massachusetts Executive Office of Environmental Affairs, Cape Cod Watershed Team, Boston, MA.

Maietta, R. 1989a. Memorandum to Arthur S. Johnson, MA DEP Biomonitoring Program Manager. *1988 Paskamanset River Fish Toxics Monitoring*. 10 September 1989. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Maietta, R. 1989b. Memorandum to Arthur S. Johnson, MA DEP Biomonitoring Program Manager. *1988 Copicut and Shingle Island Rivers Toxics in Fish Monitoring*. 5 October 1989. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Maietta, R. J. 2000. *1999 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys*. Massachusetts Department of Environmental Protection, Divisions of Watershed Management and Environmental Analysis. Worcester, MA.

Maietta, R. and Colonna-Romano, J. 2001. *2000 Fish Toxics Monitoring Public Requests and Year 2 Watershed Surveys*. Massachusetts Department of Environmental Protection, Divisions of Watershed Management and Environmental Analysis. Worcester, MA.

Malkoski, V. (Vincent.Malkoski@state.ma.us) 2002. *DMF Studies in the Buzzards Bay Watershed*. Massachusetts Division of Marine Fisheries, Pocasset, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 26 August 2002.

MassGIS. 2002. *Hydrography - statewide 1:25,000*. MassGIS (MA Office of Geographic and Environmental Information), Executive Office of Environmental Affairs, Boston, MA.

MassWildlife. 2001. Draft April 2000 *Coldwater Fisheries Resources List*. Massachusetts Department of Fisheries Wildlife and Environmental Law Enforcement, Division of Fisheries and Wildlife (MassWildlife), Westborough, MA.

Mattapoissett BOH. 2003. *Public Beach Water Quality Information for Mattapoissett beaches*. Personal Communication with Andrea Langhauser, MA DEP, Mattapoissett Board of Health, Mattapoissett, MA.

Mattson, M.D., P.J. Godfrey, R.A. Barletta and A. Aiello, 1998. *Eutrophication and Aquatic Plant Management in Massachusetts Draft Generic Environmental Impact Report*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA and Massachusetts Department of Environmental Management, Boston, MA. 435pp.

Mattson, M. 2002. Personal Communication. *Buzzards Bay Watershed: Lakes TMDL information*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

Mattson, M. 2003. *Baseline Lake Survey 2000 Technical Memorandum DWM CN 161.0. (TM-S-15)*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

McCobb, T. D., and LeBlanc, D. R., 2002, Detection of Fresh Ground Water and a Contaminant Plume beneath Red Brook Harbor, Cape Cod, Massachusetts, 2000: U.S. Geological Survey Water-Resources Investigations Report 02-4166, 36 p.

MCWW. 2000. Acushnet River Shoreline Survey. Final Report. April 26, 2000. Massachusetts Community Water Watch UMass Dartmouth. North Dartmouth, MA.

MDPH. 1969. *Article 7 Regulation 10.2B of the State Sanitary Code*. Commonwealth of Massachusetts. Department of Public Health. Boston, MA.

MDPH. 1994. *Public Health Interim Freshwater Fish Consumption Advisory*. Massachusetts Department of Public Health, Boston, MA.

MDPH. 2001a. *Public Health Statewide Fish Consumption Advisory issued July 2001*. The Commonwealth of Massachusetts, Bureau of Environmental Health Assessment, Boston, MA.

MDPH. 2001b. *Recreational Use Of Water Bodies On Or Near The Massachusetts Military Reservation (MMR) Community Fact Sheet – Annual Update, May 2001*. [Online]
<http://www.state.ma.us/dph/beha/epi/reports/cape/pond%5Ffact%5Fsht.htm> Massachusetts Department of Public Health, Boston, MA.

MDPH. 2002a. *105 CMR 445.000: Minimum Standards For Bathing Beaches, State Sanitary Code, Chapter VII*. Massachusetts Department of Public Health, Division of Community Sanitation Regulations and Statutes [Online]
<http://www.state.ma.us/dph/dcs/csanregs.htm>. 19 September 2002.

MDPH. 2002b. *Beach Closure/Reopening Information*. Email from Jennifer Murphy (Jennifer.Murphy@dph.state.ma.us) Massachusetts Department of Public Health, Boston, MA. to Laurie Kennedy Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 13 November 2002.

MDPH. 2002c. *Freshwater Fish Consumption Advisory List -- June 2002*. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment. Boston, MA.

MDPH. 2002d. *Health consultation Red Brook Harbor and Squeteague Harbors, Bourne, Massachusetts*. Massachusetts Department of Health, Environmental Public Health Center. Boston, MA.

New Bedford BOH. 2002. *Snipatuit Pond Bacteria Data and Marys Pond Beach Information*. Personal Communication from the New Bedford Board of Health to Chris DeRolph, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester.

NHESP. 1999. MA Certified Vernal Pools NHSEP 1999-2001 (MassGIS datalayer). Natural Heritage and Endangered Species Program, Massachusetts Division of Fisheries, Wildlife and Environmental Law Enforcement, Westborough, MA

NHESP 2002. Unpublished data. Massachusetts Division of Fisheries and Wildlife. Natural Heritage & Endangered Species program. Westborough, MA.

Nelson, W.G. B.J. Bergen, S.J. Benyi, G. Morrison, R.A. Voyer, C.J. Strobel, S. Rego, G. Thursby, and C.E. Pesch. 1996. New Bedford Harbor Long-Term Monitoring Assessment Report: Baseline Sampling. U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, RI. EPA/600/R-96/097

Nelson, W. 2003. *New Bedford Harbor Long-Term Monitoring Update*. Personal Communication with Katie O'Brien, MA DEP. U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, RI.

Nuzzo, R. 1999. (Revised 8 May 2002). *Standard Operating Procedures Water Quality Monitoring In Streams Using Aquatic Macroinvertebrates. CN 039.1*. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA

O'Shea, L. (Leslie.Oshea@state.ma.us) 2002. *WMA/Cranberry Bog Conversion Factor*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Lakeville, MA. Email to Susan Connors, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 16 April 2002.

O'Shea, L. (Leslie.Oshea@state.ma.us) 2003. *WMA Information in the Buzzards Bay Watershed*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Lakeville, MA. Email to Katie O'Brien at Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated March 2003.

Peirce, J. (Jane.Peirce@state.ma.us) 2003. *Indicative Project Summary for Head of Westport Stormwater Project Section 319 NPS Project 02-06/319*. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 22 January 2003.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. Water Resources Branch, Ontario Ministry of the Environment, Queen's Printer for Ontario, Canada.

Richards, T. (Todd.Richards@state.ma.us). 2003. *Buzzards Bay Watershed Fish Population Data—Acushnet and Mattapoissett rivers*. Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Fisheries and Wildlife, Westborough, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 17 March 2003.

Riverways. 2002. *Riverways Newsletter Spring 2002*. [Online] Massachusetts Riverways Programs, Department of Fisheries, Wildlife, and Environmental Law Enforcement, Boston, MA.

Rojko, A.M., W.A. Kimball, and A.J. Screpetis. 1995. *Designated Outstanding Resource Waters of Massachusetts 1995*. Massachusetts Executive Office of Environmental Affairs, Department of Environmental Protection, Bureau of Resource Protection, Office of Watershed Management. Grafton, MA.

Ruthven, Trey, S.W. Kelley, J. M. Cote, J. S. Ramsey. May 2003. *Hydrodynamic Analysis of Slocums River and Little river, Dartmouth Massachusetts. Draft Report*. Applied Coastal Research and Engineering, Inc., Mashpee, Massachusetts

Russell, E. 2003. *Six Ponds Testing*. Six Ponds Association, Plymouth, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA dated 24 March 2003.

Scarlet, G. 2003. Personal Communication. *Buzzards Bay Watershed: Storm Water Permitting Information*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

Screpetis, A.J. (Arthur.Screpetis@state.ma.us) 2002. *Acushnet River TMDL Information* Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA. Email to Katie O'Brien, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA

Socolow, R.S., Leighton, C.R., Zanca, J.L., and Ramsbey, L.R. 1998. *Water Resources Data Massachusetts And Rhode Island Water Year 1997*. U.S. Geological Survey Water-Data Report MA-RI-97-1. Northborough, MA

Socolow, R.S., Comeau, L.Y., Zanca, J.L., and Ramsbey, L.R. 1999. *Water Resources Data, Massachusetts And Rhode Island Water Year 1998*. U.S. Geological Survey Water-Data Report MA-RI-98-1. Northborough, MA

Socolow, R.S., Zanca, J.L., Murino, D., and Ramsbey, L.R. 2000. *Water resources data Massachusetts and Rhode Island water year 1999*. U.S. Geological Survey Water-Data Report MA-RI-99-1. Northborough, MA

Socolow, R.S., Whitley, J.S., Murino, D, and Ramsbey, L.R. 2001. *Water Resources Data, Massachusetts and Rhode Island water year 2000*. U.S. Geological Survey Water-Data Report MA-RI-00-1. Northborough, MA

Socolow, R.S., Leighton, C.R., Whitley, J.F., and Ventetuolo, D.J. 2002. *Water Resources Data, Massachusetts and Rhode Island, Water Year 2001*. U.S. Geological Survey Water-Data Report MA-RI-01-1. Northborough, MA

Stein, E.D., Y. Cohen, and A.M. Winer. 1996. *Environmental Distribution and Transformation of Mercury Compounds*. Critical Reviews in Environmental Science and Technology 26(1):1-43.

Tatsutani, M. Editor. NESCAUM, NEWMOA, NEIWPC, EMAN. 1998. *Northeast States/Eastern Canadian Provinces Mercury Study A Framework for Action*. Northeast States for Coordinated Air Use Management (NESCAUM), Northeast Waste Management Officials' Association (NEWMOA), New England Interstate Water Pollution Control Commission (NEIWPC), and Canadian Ecological Monitoring and Assessment Network (EMAN).

Turner, J.T., J.A. Lincoln, D.G. Borkman, D.A. Gauthier, J.T. Kiesser, and C.A. Dunn. 2003 *Nutrients, Eutrophication and Harmful Algal Blooms in Buzzards Bay, Massachusetts*. (Project 99-03/MWI). Center for Marine Science and Technology, University of Massachusetts Dartmouth, New Bedford, MA.

UMass Amherst. 1999. *Land Use Datalayer - statewide 1:25000*. Published by MassGIS (MA Office of Geographic and Environmental Information), Executive Office of Environmental Affairs for the Resource Mapping Project at the University of Massachusetts Amherst, MA.

USGS. 5 June 2001. [Online]. Massachusetts and Rhode Island *August 1999 Drought Statement*. United States Geological Survey. http://ma.water.usgs.gov/current_cond/august_1999_statement.htm. 5 September 2001.

USGS. October 2002. [Online] *Streamflow Statistics for Massachusetts (Stream Stats)- Paskamsket River Gage 01150933*. United States Geological Survey. Northborough, MA <http://ststdmamrl.er.usgs.gov/streamstats/expert.htm>

- Wandell, S.W. and Mary A. Morgan. 1984. *Gazetteer of Hydrologic Characteristics of Streams in Massachusetts—Coastal River Basins of the South Shore and Buzzards Bay*. U.S. Geological Survey. Water Resources Investigations Report 84-4288, Boston, MA
- Wareham BOH. 2003. *Bacteria Data from Town Bathing Beaches*. Personal Communication from the Wareham Board of Health to Andrea Langhauser, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester. MA.
- Wayland III, R.H. 2001. Memorandum to EPA Regional Water Management Directors, EPA Regional Science and Technology Directors, and State, Territory and Authorized Tribe Water Quality Program Directors dated 19 November 2001. Re: *2002 Integrated Water Quality Monitoring and Assessment Report Guidance*. United States Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds. Washington, DC.
- Whittaker, D. 1999. *Sanitary Survey of New Bedford/Fairhaven Inner Harbor in the City of New Bedford and the Town of Fairhaven BB:15.1*. Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries, Pocasset, MA.
- Whittaker, D. 2003. (David.Whittaker@state.ma.us) *Southeast Region Shellfish Classification List Updates*. Department of Fisheries, Wildlife, and Environmental Law Enforcement, Division of Marine Fisheries, Pocasset, MA. Emails to Laurie Kennedy, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA. Dated March 2003.
- WRST. 2002. *Weweantic River Stream Team Report Shoreline Survey Report and Action Plan*. Department of Fisheries, Wildlife, and Environmental Law Enforcement Adopt-A Stream Program- Weweatic River Stream Team, Carver, MA
- WRWA. Undated. Westport River Watershed Alliance Homepage <http://www.wrwa.com/> Westport River Watershed Alliance, Westport, MA. 31 January 2003.
- WRWA. 2001. *Westport River Watershed Alliance QAPP for Monitoring salinity, Turbidity, Temperature, pH, and Fecal Coliform and Fecal Streptococcus Bacteria Parameters on the Westport River*. Westport River Watershed Alliance. Westport, MA. July 2001.

BUZZARDS BAY

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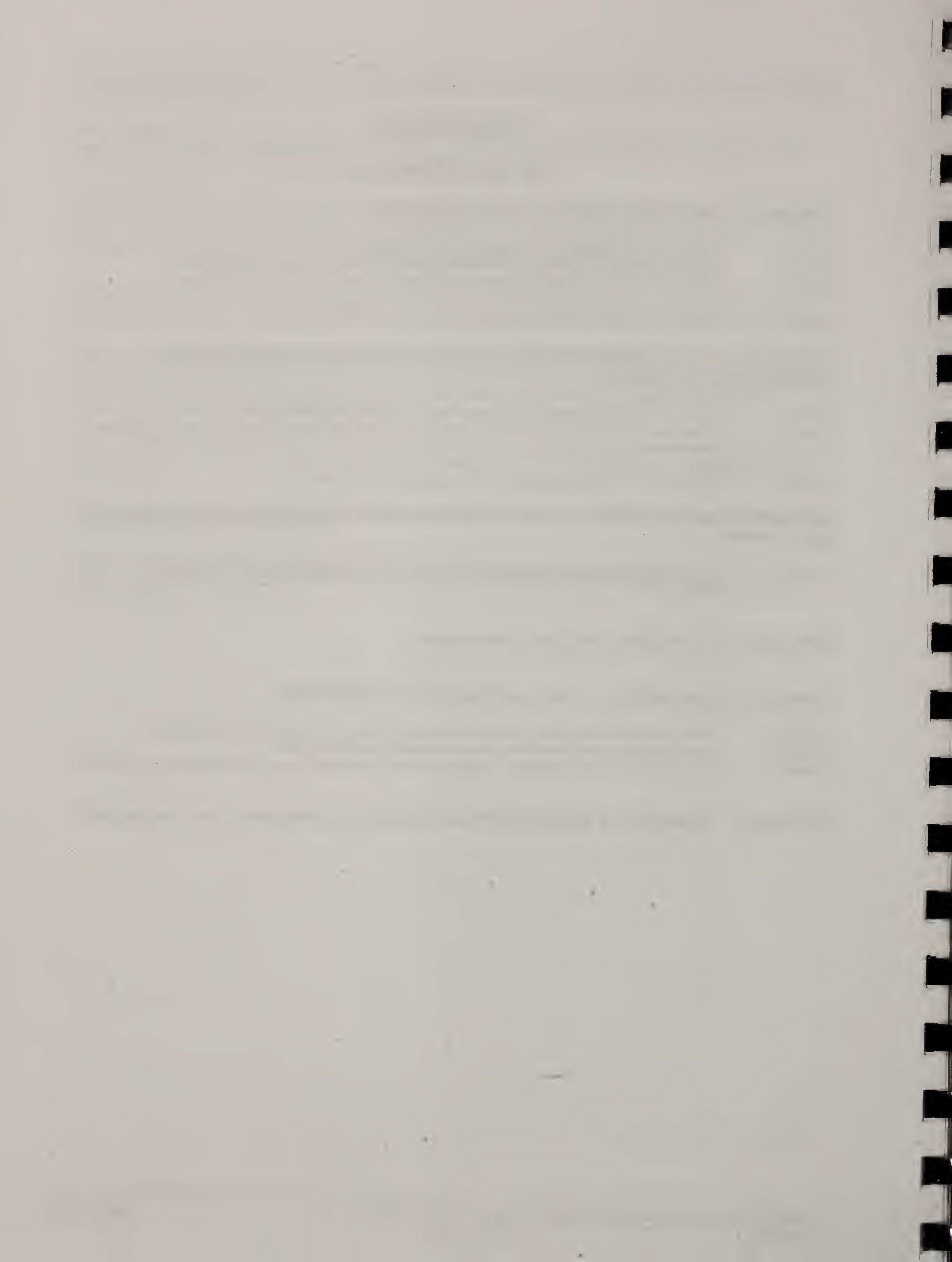
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APPENDIX A

DWM LAKES SURVEY DATA 1995 AND 2000

1995

In the Buzzards Bay Watershed, DWM conducted synoptic surveys at 64 lakes during 1995. Observations, from at least one access point on each lake (multiple access points on larger lakes) were recorded on standardized field sheets. An attempt was made to observe the entire surface area of each lake to determine the extent of areal macrophyte cover. At each sampling location general water quality conditions, identification and abundance of aquatic and wetland macrophyte plant species, and estimates of total percent areal coverage were recorded. Macrophyte visual observations were augmented at each station by identifying plant specimens collected from the lake bottom. Specimens were retrieved using a "rake" (a short handled, double-sided garden rake on a 50 foot line) thrown to its maximum extension in multiple directions at each station. Macrophytes collected in the "rake" were identified (in-situ or in the laboratory) and recorded on the field sheets. Transparency was measured where possible using a standard 20-centimeter diameter Secchi disk. Where Secchi disk measurements were not feasible, transparency was estimated as being above or below 1.2 meter (the MDPH bathing beach standard). Trophic status was estimated primarily using visual observations of macrophyte cover and phytoplankton populations. A more definitive assessment of trophic status would require more extensive collection of water quality and biological data.

Table A1. Buzzard Bay Watershed 1995 Summer Lake Status.

| Lake, Location | WBID | Size (Acres) | TROPHIC STATUS | SURVEY OBSERVATIONS (Objectionable Conditions) |
|------------------------------|-------|--------------|----------------|--|
| Abner Pond, Plymouth | 95001 | 10 | U | Water level low, silty muck and undecomposed matter on bottom, moderate cover of floating and emergent plants around most of pond |
| Barrett Pond, Carver | 95004 | 16 | M | Slightly turbid water, scum on surface, extensive undecomposed debris on sandy bottom, moderate to dense patches of submerged vegetation |
| Bates Pond, Carver | 95007 | 20 | E | Slightly turbid water, extensive partially decomposed debris on bottom, water level low, dense cover of floating vegetation, very dense cover of submerged vegetation over 50% of pond |
| Big Rocky Pond, Plymouth | 95119 | 18 | U | Good water clarity, water level low, silt and undecomposed matter over sand bottom, sparse vegetation |
| Big Sandy Pond, Plymouth | 95011 | 135 | U | Good water clarity, slight mucky debris on bottom, sparse vegetation, many cottages and numerous recreational boats |
| Blackmore Reservoir, Wareham | 95015 | 46 | U | Turbid water, extensive debris on windward shore, water level low, evidence of blue greens in windrows, dense low-growing plant cover on bottom, developed shoreline |
| Cedar Dell Lake, Dartmouth | 95021 | 24 | E | Visible only from a distance, 100% floating vegetative cover |
| Charge Pond, Plymouth | 95025 | 23 | U | Excellent water clarity, slight silting on sand and vegetation, water level low, moderate low-growing plant cover on bottom |
| College Pond, Plymouth | 95030 | 53 | M | Slightly turbid water, moderate muck and undecomposed debris over sandy bottom, some algal clouds on bottom, sparse plant cover |
| Crane Brook Bog Pond, Carver | 95033 | 37 | E | 100% cover of floating vegetation and duckweed, no open water, pond filling in |

* Indicates Class A (water supply) water body; all others are Class B.

WBID – Water body Identification code.

Trophic State: E= Eutrophic, H= Hypereutrophic, M= Mesotrophic, U= Undetermined.

Non-native Plants: Ls = *Lythrum salicaria*, Mh = *Myriophyllum heterophyllum*, Pa = *Phragmites australis*, Cc = *Cabomba Caroliniana*

Note: M. sp. – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

Table A1 (Continued). Buzzards Bay Watershed 1995 Summer Lake Status.

| Lake, Location | WBID | Size (Acres) | TROPHIC STATUS | SURVEY OBSERVATIONS (Objectionable Conditions) |
|------------------------------------|-------|--------------|----------------|--|
| Curlew Pond, Plymouth | 95034 | 43 | M | Slightly turbid water, silt over sand/gravel bottom, floccy green algae on bottom, water level low, moderate to dense submerged vegetation, moderate cottage/campsite density |
| Deer Pond, Plymouth | 95036 | 11 | U | Very slightly turbid water, organic muck on bottom, green/brown periphyton present, 10% dense emergent vegetation near shoreline, possible non-native (<i>M. sp.</i>), large bog next to pond |
| Dicks Pond, Wareham | 95038 | 40 | U | Turbid water, silty organic bottom, <i>Phragmites</i> present, dense vegetation near shore, majority of water open. <i>Myriophyllum sp.</i> noted not likely <i>heterophyllum</i> . |
| Dunham Pond, Carver | 95044 | 45 | U | Good water clarity, slight silt and undecomposed matter over sandy bottom, water level low, dense mat of submerged low growing vegetation |
| East Head Pond, Carver/Plymouth | 95177 | 92 | M | Slightly turbid water, extensive undecomposed debris over sandy bottom, algal/bacterial floc on many plants, scattered patches of very dense floating vegetation, submerged plants moderate, possible non-native (<i>M. sp.</i>) |
| Ezekiel Pond, Plymouth | 95051 | 36 | U | Good water clarity, water level low, green periphyton present, extensive debris over sandy bottom, patches of emergents along undeveloped shore, submerged plants common, mostly developed shoreline |
| Fawn Pond, Plymouth | 95053 | 33 | U | Slightly turbid water, silt on plants and sand/gravel bottom, water level slightly low, scattered emergents around shore |
| Fearing Pond, Plymouth | 95054 | 24 | U | Slightly turbid water near beach, good water clarity otherwise, water level low, fine brown silt and undecomposed matter over sand bottom, moderate to dense low-growing plants, shoreline erosion at several points |
| Federal Pond, Carver | 95055 | 129 | E | Turbid water, very mucky organic bottom, floc on plants, 100% very dense cover of floating and submerged vegetation in upper end, lower end unobserved, water appears more open in center of pond, non-natives present (<i>Mh</i> and <i>Cc</i>) |
| Five Mile Pond, Plymouth | 95056 | 29 | U | Good water clarity, some undecomposed matter over sand/gravel/rock bottom, sparse vegetation |
| Fresh Meadow Pond, Carver/Plymouth | 95174 | 59 | M | Good water clarity, slight silt and undecomposed matter over sand bottom, very dense floating vegetation scattered along shore, non-natives present (<i>Cc</i> and likely <i>M. h.</i>) |
| Gallows Pond, Plymouth | 95059 | 43 | U | Good water clarity, fine silt over sandy bottom, residents said lime treatment administered several years ago helped plants and fish to make a comeback, sparse vegetation |
| Glen Charlie Pond, Wareham | 95061 | 185 | U | Good water clarity, slight debris on sand/gravel bottom, moderately dense development along shore, non-natives present (<i>M. sp.</i> and <i>Pa</i>) |

* Indicates Class A (water supply) water body; all others are Class B.

WBID – Water body Identification code.

Trophic State: **E**= Eutrophic, **H**= Hypereutrophic, **M**= Mesotrophic, **U**= Undetermined.

Non-native Plants: **Ls** = *Lythrum salicaria*, **Mh** = *Myriophyllum heterophyllum*, **Pa** = *Phragmites australis*, **Cc** = *Cabomba Caroliniana*

Note: **M. sp.** – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

Table A1 (Continued). Buzzards Bay Watershed 1995 Summer Lake Status.

| Lake, Location | WBID | Size (Acres) | TROPHIC STATUS | SURVEY OBSERVATIONS (Objectable Conditions) |
|-----------------------------|-------|--------------|----------------|--|
| Halfway Pond, Plymouth | 95178 | 232 | M | Slightly turbid water, rock/gravel bottom, orange stain on rocks near intake channel, algal bloom next to intake/outflow from bog, dense vegetation along western cove, possible non-native (M. sp.) |
| Horseshoe Pond, Wareham | 95075 | 85 | U | Moderate turbidity, stain in water, control structure exposed, pond lowered, only a stream through old pond |
| Kings Pond, Plymouth | 95078 | 21 | E | Observed from a distance, very dense vegetation around perimeter and in northeast cove, developed shoreline |
| Leonards Pond, Rochester | 95080 | 54 | U | Tea stain, mucky bottom, very dense duckweed and floating leaf vegetation near outlet to bog, most of pond open water, many Canadian Geese present, possible non-native (M. sp.) |
| Little Long Pond, Plymouth | 95088 | 45 | U | Good water clarity, slight algal floc over sand/gravel bottom, sparse vegetation |
| Little Long Pond, Wareham | 95089 | 19 | E | Slightly turbid water, extensive non-algal floating debris, mucky organic bottom, filamentous algae dense to very dense, floating, submerged, and emergent vegetation encroaching almost to the center |
| Little Rocky Pond, Plymouth | 95091 | 11 | E | Good water clarity, mucky organic bottom, 75-100% vegetative cover over entire pond |
| Little Sandy Pond, Plymouth | 95092 | 29 | U | Good water clarity, water level low, some debris over sand/gravel bottom, black decomposing material along shore (possibly from filamentous algae washing ashore), sparse vegetation, possible non-native (M. sp.) |
| Little West Pond, Plymouth | 95093 | 25 | U | Good water clarity, brown silt on plants and rocks, water level low, very dense low-growing plants |
| Long Duck Pond, Plymouth | 95095 | 23 | E | Little open water, mucky bottom, water level low, 100% cover of floating leaf and emergent plants. Survey also conducted in September 1996 with same general observations. |
| Long Pond, Plymouth | 95096 | 211 | U | Good water clarity, some debris on sand/gravel bottom, sparse vegetation, developed shoreline |
| Mare Pond, Plymouth | 95172 | 12 | M | Slightly turbid water, slight stain, algal clouds, abundant organics on bottom near center of lake, 20% with very dense floating leaf plants, beach erosion apparent, cranberry bog adjacent, developed shoreline |
| Marys Pond, Rochester | 95100 | 81 | U | Slightly turbid water, water level low, silt over sand/gravel/rock bottom, sparse vegetation |
| Micajah Pond, Plymouth | 95102 | 20 | U | Good water clarity, silt over sand/gravel bottom, sparse vegetation, moderate density of cottages. <i>Myriophyllum</i> sp. noted not likely <i>heterophyllum</i> . |
| Mill Pond, Wareham | 95105 | 150 | E | Slight to moderately turbid water, organics over sand bottom, very dense emergent and floating vegetation around perimeter and northeast arm, non-native present (Mh) |

* Indicates Class A (water supply) water body; all others are Class B.

WBID – Water body Identification code.

Trophic State: E= Eutrophic, H= Hypereutrophic, M= Mesotrophic, U= Undetermined.

Non-native Plants: Ls = *Lythrum salicaria*, Mh = *Myriophyllum heterophyllum*, Pa = *Phragmites australis*, Cc = *Cabomba caroliniana*

Note: M. sp. – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

Table A1 (Continued). Buzzards Bay Watershed 1995 Summer Lake Status.

| Lake, Location | WBID | Size (Acres) | TROPHIC STATUS | SURVEY OBSERVATIONS (Objectionable Conditions) |
|--|-------|--------------|----------------|---|
| New Bedford Reservoir, Acushnet | 95110 | 219 | E | Turbid water, partly decomposed matter over gravel/rock bottom, very dense floating vegetation around perimeter (mainly in west cove and eastern shore), non-native present (Mh) |
| New Long Pond, Plymouth | 95112 | 23 | E | Slightly turbid water, water level low, extensive undecomposed debris over sand bottom, 100% cover of emergent, floating, and submerged vegetation |
| Noquochoke Lake, Dartmouth | 95113 | 110 | E | Very turbid water (likely <4' Secchi), brown scum in cove area, 75% cover of floating and submerged vegetation in small cove, remaining basin mostly open water, east and south shores developed, non-native present (Mh) |
| Noquochoke Lake (East Basin), Dartmouth | 95170 | 17 | E | Very dense submerged vegetation over most of area, non-native present (Mh) |
| Noquochoke Lake (North Basin), Dartmouth | 95171 | 19 | E | Brown, turbid water (likely <4' Secchi), 100% covered with duckweed and submergent vegetation, highly developed shore, non-native present (Mh) |
| Parker Mills Pond, Wareham | 95115 | 105 | E | Turbid water, mucky black organic sediment on bottom, very dense duckweed and submerged vegetation, non-native present (Mh) |
| Rocky Meadow Brook Pond, Carver | 95118 | 11 | U | Slightly turbid water, tea stain, extensive undecomposed debris over sand bottom, encroachment by vegetation apparent along entire shore |
| Rocky Pond, Plymouth | 95179 | 18 | U | Difficult to access and observe, widely scattered dense patches of vegetation |
| Round Pond, Plymouth | 95123 | 10 | M | Good water clarity, extensive undecomposed debris over sand bottom, water level low, evidence of past algal bloom on shore, dense low-growing vegetation |
| Sampson Pond, Carver | 95125 | 310 | U | Good water clarity, silt over sand/gravel/rock bottom, encroaching emergent vegetation near outlet, non-native present (Cc) |
| Sand Pond, Wareham | 95127 | 15 | U | Good water clarity, silt over sand bottom and low vegetation, water level low, few emergent patches around perimeter |
| Sandy Pond, Wareham | 95128 | 18 | M | Slightly turbid water, water level low, mucky bottom, dense to very dense floating and emergent vegetation around majority of perimeter and east end |
| Sassaquin Pond, New Bedford | 95129 | 34 | U | Good water clarity, water level low, slight debris over gravel/rock bottom, multiple storm drain outlets around pond, non-natives present (Ls and Pa) |
| South Meadow Brook Pond, Carver | 95139 | 25 | E | Little open water, mucky bottom, water level low, many stumps exposed, 100% covered with duckweed and floating vegetation |
| South Meadow Pond, Carver | 95140 | 17 | M | Slightly turbid water, water level low, weedy bottom over sand/gravel, very dense floating and submerged vegetation along perimeter of southern shore |
| Southwest Atwood Bog Pond, Carver | 95141 | 14 | E | Difficult to access and observe, limited open water, 100% floating vegetation cover on west side, east side open with many stumps visible |

* Indicates Class A (water supply) water body; all others are Class B.

WBID – Water body Identification code.

Trophic State: E= Eutrophic, H= Hypereutrophic, M= Mesotrophic, U= Undetermined.

Non-native Plants: Ls = *Lythrum salicaria*, Mh = *Myriophyllum heterophyllum*, Pa = *Phragmites australis*, Cc = *Cabomba caroliniana*

Note: M. sp. – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

Table A1 (Continued). Buzzards Bay Watershed 1995 Summer Lake Status.

| Lake, Location | WBID | Size (Acres) | TROPHIC STATUS | SURVEY OBSERVATIONS (Objectionable Conditions) |
|-------------------------------------|-------|--------------|----------------|--|
| Spectacle Pond, Wareham | 95142 | 42 | U | Good water clarity, sand/gravel bottom, dense patches of lilies and encroaching emergent vegetation at north end |
| Three Cornered Pond, Plymouth | 95145 | 14 | E | Slightly turbid water, water level low, undecomposed and mucky debris over sand bottom, little open water in center, very dense emergent vegetation over entire pond |
| Tihonet Pond, Wareham | 95146 | 89 | M | Slightly turbid water, periphyton apparent over sand/gravel bottom, dense floating vegetation to right of dam, but sparse elsewhere |
| Tinkham Pond, Mattapoisett/Acushnet | 95148 | 20 | U | Slightly turbid water, tea stain, very dense floating and emergent vegetation around majority of shoreline |
| Tremont Mill Pond, Wareham | 95150 | 50 | U | Turbid water, tea stain, extensive debris over rocky bottom, non-native present (Mh) |
| Turner Pond, New Bedford/Dartmouth | 95151 | 55 | U | Slightly turbid water, dark tea stain, Secchi disk .6m, water level low, encroaching emergent vegetation in northeast basin, dense cover in southwest cove |
| Union Pond, Wareham | 95152 | 25 | U | Good water clarity, organic bottom, dense to very dense cover of lilies around perimeter |
| Vaughn Pond, Carver | 95153 | 22 | M | Slightly turbid water, plants over sand bottom, slight stain, water level low, very dense submerged and emergent vegetation along northeast shore |
| White Island Pond (west), Plymouth | 95173 | 125 | U | Turbid water, organic debris over sand bottom, non-native present (Cc), sparse vegetation, dense development along shoreline |
| Whites Pond, Plymouth | 95168 | 33 | M | Slightly turbid water, extensive debris and algae on plants and over sand/gravel bottom, submerged growth heavy with periphyton, emergent patches on southwest side |

* Indicates Class A (water supply) water body; all others are Class B.

WBID – Water body Identification code.

Trophic State: **E**= Eutrophic, **H**= Hypereutrophic, **M**= Mesotrophic, **U**= Undetermined.

Non-native Plants: **Ls** = *Lythrum salicaria*, **Mh** = *Myriophyllum heterophyllum*, **Pa** = *Phragmites australis*, **Cc** = *Cabomba caroliniana*

Note: **M. sp.** – Possible *Myriophyllum heterophyllum*, requires further confirmation when flowering heads are evident.

2000

In the Buzzards Bay Watershed, baseline lake surveys were conducted in July, August, and September 2000 to coincide with maximum growth of aquatic vegetation, highest recreational use, and highest lake productivity. Crane Brook Bog Pond, Federal Pond, New Bedford Reservoir, New Long Pond, Parker Mills Pond, Turner Pond, and White Island Pond were sampled three times each (generally at monthly intervals). A technical memorandum by Dr. Mark Mattson entitled *Baseline Lakes 2000 Technical Memo (TM-S-15)* provides details of sample collection methods, results, data, and weed maps for the lakes surveyed in the Deerfield, Millers, Shawsheen, Ipswich, Islands, and Buzzards Bay watersheds in 2000. Hydrolab® Multiprobe data and physico-chemical data are excerpted below.

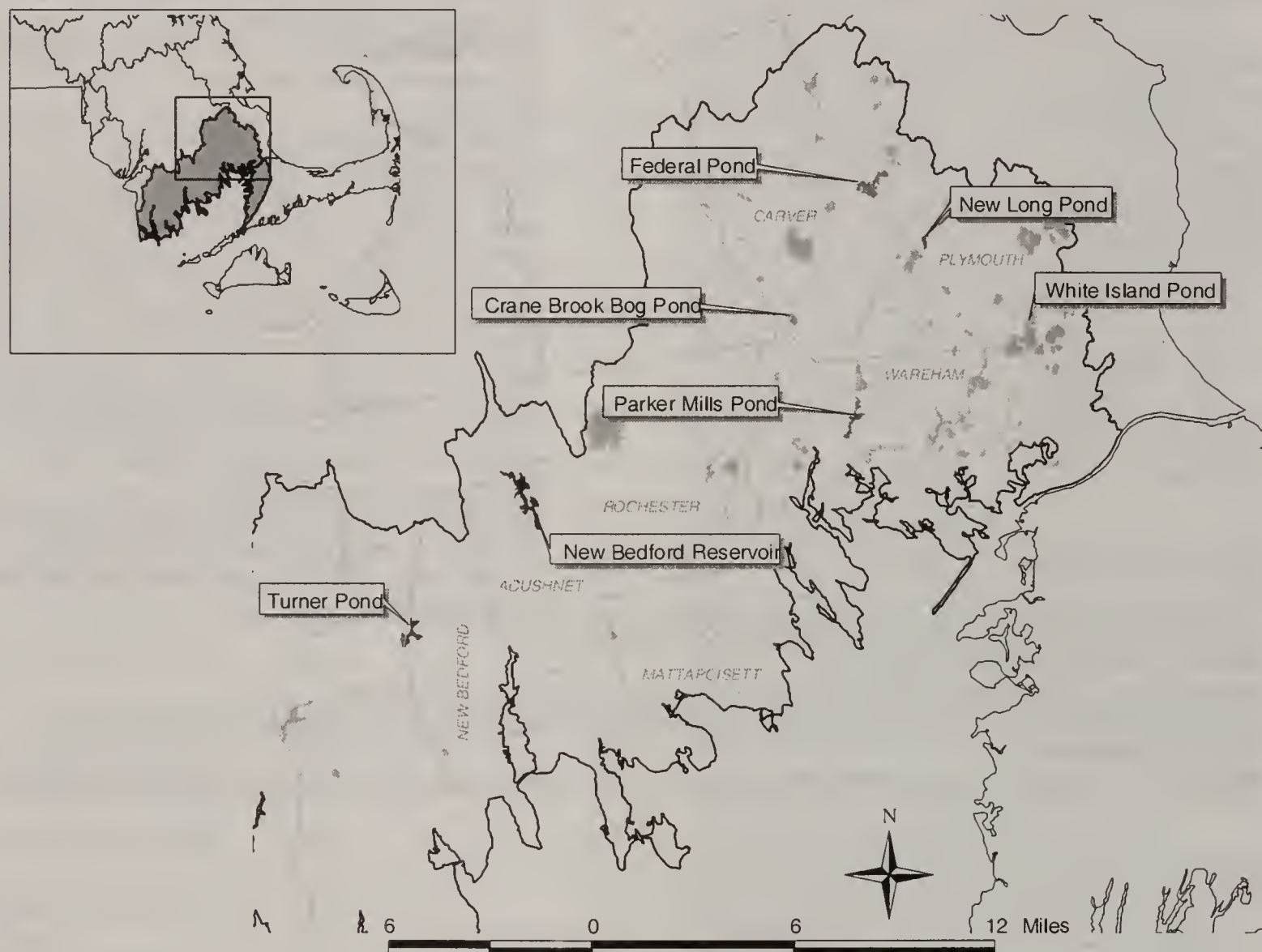


Figure A1. Buzzards Bay Watershed 2000 Baseline Lakes Survey Locations

Table A2. 2000 DEP DWM Buzzards Bay Watershed Baseline Lakes *In-situ* Hydrolab® Data

| Date | OWMID | Time (24hr) | Depth (m) | Temp (C) | pH (SU) | Cond@ 25C (uS/cm) | TDS (mg/l) | DO (mg/l) | SAT (%) |
|--|---------|----------------|--------------|-------------|------------|-------------------------|---------------|--------------|------------|
| Crane Brook Bog Pond (Palis: 95033) | | | | | | | | | |
| Unique_ID: WO790 Station: A | | | | | | | | | |
| Description: deep hole, northern end of pond, Carver | | | | | | | | | |
| 7/13/2000 | | | | | | | | | |
| | LB-0674 | 16:03 | 0.3 | 25.3u | 5.9 | 63.8 | 40.8 | 7.1 | 85 |
| 8/10/2000 | | | | | | | | | |
| | LB-0763 | 10:29 | 0.5 | 24.7 | 5.9 | 63.5 | 40.6 | **u | **u |
| 9/14/2000 | | | | | | | | | |
| | LB-0854 | 10:42 | 0.3 | 20.4 | 5.7 | 63.2 | 40.4 | 3.7 | 40 |
| Federal Pond (Palis: 95055) | | | | | | | | | |
| Unique_ID: WO763 Station: A | | | | | | | | | |
| Description: deep hole between larger islands of southern lobe, Carver | | | | | | | | | |
| 7/20/2000 | | | | | | | | | |
| | LB-1033 | 14:25 | ** m | **m | **m | **m | -- | **m | -- |
| | | 14:28 | ** m | **m | **m | **m | -- | **m | -- |
| | | 14:31 | ** m | **m | **m | **m | -- | **m | -- |
| | LB-1033 | 14:34 | ** m | **m | **m | **m | -- | **m | -- |
| | | 14:37 | ** m | **m | **m | **m | -- | **m | -- |
| 8/16/2000 | | | | | | | | | |
| | LB-1073 | 11:04 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:07 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:12 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:16 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:19 | ** m | **m | **m | **m | -- | **m | -- |
| 9/12/2000 | | | | | | | | | |
| | LB-1116 | 12:20 | 0.1 | 22.8 | 6.6 | 42.5 | -- | 8.9 | -- |
| | | 12:23 | 0.5 | 22.7 | 6.6 | 42.5 | -- | 8.9 | -- |
| | | 12:27 | 1.0 | 22.0 | 6.6 | 42.3 | -- | 9.1 | -- |
| | | 12:31 | 1.5 | 21.6 | 6.1 | 42.7 | -- | 6.2u | -- |
| | | 12:36 | 2.0 | 20.3 | 5.5 | 44.4 | -- | 1.4 | -- |
| New Bedford Reservoir (Palis: 95110) | | | | | | | | | |
| Unique_ID: WO781 Station: A | | | | | | | | | |
| Description: deep hole in southeast end of North Basin, Acushnet | | | | | | | | | |
| 7/18/2000 | | | | | | | | | |
| | LB-0634 | 16:01 | 0.5 | 25.0 | 6.2 | 90.1 | 57.7 | 4.9 | 58 |
| | | 16:05 | 1.5 | 24.3 | 6.1 | 90.6 | 58.0 | 3.4 | 40 |
| | | 16:10 | 2.0 | 23.7u | 6.0 | 91.1 | 58.3 | 1.7 | 19 |
| 8/15/2000 | | | | | | | | | |
| | LB-0729 | 15:01 | 0.5 | 22.1 | 6.2 | 86.3 | 55.2 | 5.2 | 59 |
| | | 15:07 | 1.6 | 21.9 | 6.1 | 86.7 | 55.5 | 3.9 | 44 |
| | | 15:18 | 2.3 | 21.8 | 6.0 | 87.3 | 55.9 | 3.3 | 37 |
| 9/19/2000 | | | | | | | | | |
| | LB-0826 | 11:44 | 0.5 | 19.8 | 6.2 | 88.7 | 56.7 | 5.7 | 61 |
| | | 11:52 | 1.5 | 19.0 | 6.0 | 88.2 | 56.5 | 3.7 | 39 |
| | | 11:56 | 2.0 | 18.7 | 5.9 | 88.1 | 56.4 | 3.2 | 33 |

“ ** ” = Censored or missing data (i.e., data that should have been reported)

“ -- ” = No data (i.e., data not taken/not required)

“ m ” = method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed, i.e. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

“ u ” = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc

Table A2 (Continued). 2000 DEP DWM Buzzards Bay Watershed Baseline Lakes *In-situ* Hydrolab® Data

| Date | OWMID | Time (24hr) | Depth (m) | Temp (C) | pH (SU) | Cond@ 25C (uS/cm) | TDS (mg/l) | DO (mg/l) | SAT (%) |
|---|---------|----------------|--------------|-------------|------------|-------------------------|---------------|--------------|------------|
| New Bedford Reservoir (Palis: 95110) | | | | | | | | | |
| Unique_ID: WO782 Station: B | | | | | | | | | |
| Description: deep hole in southern end of South Basin, Acushnet | | | | | | | | | |
| 8/15/2000 | | | | | | | | | |
| | LB-0733 | 16:42 | 0.5 | 23.0 | 6.5 | 89.7 | 57.4 | 7.1 | 81 |
| | | 16:48 | 1.5 | 22.9 | 6.6 | 89.5 | 57.3 | 7.1 | 81 |
| | | 16:55 | 2.4 | 22.9 | 6.5 | 90.0 | 57.6 | 6.6 | 75 |
| | | 17:02 | 3.5 | 22.4u | 6.5u | 99.0u | 63.3u | **u | **u |
| | | 17:10 | 4.0 | 20.1 | 7.0 | 127 | 81.5 | <0.2 | <2 |
| 9/19/2000 | | | | | | | | | |
| | LB-0830 | 12:58 | 0.5 | 21.2 | 6.6 | 89.6 | 57.3 | 7.7 | 84 |
| | | 13:02 | 1.5 | 20.7 | 6.4 | 89.3 | 57.2 | 7.0 | 76 |
| | | 13:06 | 2.5 | 20.5 | 6.4 | 89.3 | 57.2 | 7.1 | 77 |
| | | 13:09 | 3.5 | 20.4 | 6.4 | 89.3 | 57.1 | 6.5 | 71 |
| New Bedford Reservoir (Palis: 95110) | | | | | | | | | |
| Unique_ID: 783 Station: C | | | | | | | | | |
| Description: deep hole in southeast end of East Basin, Acushnet | | | | | | | | | |
| 8/15/2000 | | | | | | | | | |
| | LB-0737 | 12:56 | 0.5 | 22.6 | 6.8 | 151 | 97.0 | 7.1 | 81 |
| | | 13:03 | 1.5 | 22.5 | 6.8 | 152 | 97.0 | 6.9u | 77u |
| New Long Pond (Palis: 95112) | | | | | | | | | |
| Unique_ID: WO780 Station: A | | | | | | | | | |
| Description: deep hole center of pond, Plymouth | | | | | | | | | |
| 7/13/2000 | | | | | | | | | |
| | LB-0664 | 11:51 | 0.3 | 26.5 | 5.6 | 34.1 | 21.8 | 7.8 | 95 |
| | | 12:00 | 1.0 | 26.0 | 5.6 | 34.0 | 21.7 | 7.8 | 94 |
| 8/17/2000 | | | | | | | | | |
| | LB-0970 | 11:38 | 0.7 | 22.3 | 5.3 | 32.0 | 20.5 | 8.1 | 91 |
| | LB-0970 | 11:44 | 1.2 | 22.3 | 5.3 | 31.9 | 20.4 | 8.1 | 91 |
| 9/14/2000 | | | | | | | | | |
| | LB-0862 | 13:27 | 0.5 | 23.7 | 5.6 | 33.5 | 21.5 | 8.5 | 98 |
| | | 13:36 | 1.1 | 23.7 | 5.6 | 33.5 | 21.5 | 8.6 | 99 |

“ ** ” = Censored or missing data (i.e., data that should have been reported)

“ -- ” = No data (i.e., data not taken/not required)

“ m ” = method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed, i.e. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

“ u ” = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc

Table A2 (Continued). 2000 DEP DWM Buzzards Bay Watershed Baseline Lakes *In-situ* Hydrolab® Data

| Date | OWMID | Time | Depth | Temp | pH | Cond@ 25C | TDS | DO | SAT |
|--|---------|--------|-------|-------|------|--------------|--------|--------|-----|
| | | (24hr) | (m) | (C) | (SU) | (uS/cm) | (mg/l) | (mg/l) | (%) |
| Parker Mills Pond (Palis: 95115) | | | | | | | | | |
| Unique_ID: WO776 Station: A | | | | | | | | | |
| Description: deep hole in southern end, Wareham | | | | | | | | | |
| 7/20/2000 | | | | | | | | | |
| | LB-1040 | 11:25 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:28 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:31 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:34 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:37 | ** m | **m | **m | **m | -- | **m | -- |
| | | 11:40 | ** m | **m | **m | **m | -- | **m | -- |
| 8/16/2000 | | | | | | | | | |
| | LB-1080 | 13:23 | ** m | **m | **m | **m | -- | **m | -- |
| | | 13:26 | ** m | **m | **m | **m | -- | **m | -- |
| | | 13:29 | ** m | **m | **m | **m | -- | **m | -- |
| | | 13:33 | ** m | **m | **m | **m | -- | **m | -- |
| | | 13:37 | ** m | **m | **m | **m | -- | **m | -- |
| | | 13:40 | ** m | **m | **m | **m | -- | **m | -- |
| 9/12/2000 | | | | | | | | | |
| | LB-1123 | 10:07 | 0.1 | 22.1 | 6.7 | 82.4 | -- | 9.4 | -- |
| | | 10:12 | 0.5 | 22.1 | 6.6 | 82.4 | -- | 9.3 | -- |
| | | 10:15 | 1.0 | 21.9 | 6.6 | 82.6 | -- | 9.2 | -- |
| | | 10:19 | 1.5 | 21.8 | 6.5 | 82.5 | -- | 9.2 | -- |
| | | 10:23 | 2.0 | 21.5 | 6.3 | 83.8 | -- | 7.0u | -- |
| Turner Pond (Palis: 95151) | | | | | | | | | |
| Unique_ID: WO774 Station: B | | | | | | | | | |
| Description: deep hole in eastern lobe of western basin, New Bedford | | | | | | | | | |
| 7/18/2000 | | | | | | | | | |
| | LB-0633 | 13:08 | 0.5 | 25.6 | 4.9 | 116 | 74.4 | 5.7 | 69 |
| | | 13:14 | 1.5 | 17.4u | 5.4 | 114 | 73.1 | <0.2 | <2 |
| | | 13:19 | 2.5 | 13.1 | 5.6 | 119 | 75.8 | <0.2 | <2 |
| | | 13:24 | 3.5 | 11.7 | 5.6 | 119 | 76.4 | <0.2 | <2 |
| 8/15/2000 | | | | | | | | | |
| | LB-0724 | 09:44 | 0.5 | 21.5 | 4.8 | 110 | 70.4 | 6.3 | 70 |
| | | 09:52 | 1.5 | **u | 4.8 | 110 | 70.3 | **u | **u |
| | | 09:59 | 2.5 | 14.7u | 5.7 | 122 | 77.9 | <0.2 | <2 |
| | | 10:05 | 3.5 | 12.3 | 5.6 | 123 | 78.4 | <0.2 | <2 |
| 9/20/2000 | | | | | | | | | |
| | LB-0819 | 12:57 | 0.5 | 21.4u | 4.7 | 117 | 74.6 | 7.0 | 78 |
| | | 13:02 | 1.5 | 18.4u | 4.7 | 119 | 76.1 | 3.3u | 35u |

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"u" = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc.

Table A2 (Continued). 2000 DEP DWM Buzzards Bay Watershed Baseline Lakes *In-situ* Hydrolab® Data

| Date | OWMID | Time (24hr) | Depth (m) | Temp (C) | pH (SU) | Cond@ 25C (uS/cm) | TDS (mg/l) | DO (mg/l) | SAT (%) |
|---|---------|----------------|--------------|-------------|------------|-------------------------|---------------|--------------|------------|
| Turner Pond (Palis: 95151) | | | | | | | | | |
| Unique_ID: WO775 Station: A | | | | | | | | | |
| Description: deep hole in southeastern lobe of eastern basin, New Bedford | | | | | | | | | |
| 7/18/2000 | | | | | | | | | |
| | LB-0620 | 11:10 | 0.5 | 24.8 | 4.7 | 122 | 78.0 | 6.5 | 77 |
| | | 11:21 | 1.5 | 20.7u | 4.7 | 116 | 73.9 | 2.0 | 22 |
| | | 11:26 | 2.5 | 13.2 | 5.0 | 117 | 75.2 | <0.2 | <2 |
| | | 11:30 | 3.5 | 11.1 | 4.9 | 117 | 74.8 | <0.2 | <2 |
| | | 11:34 | 4.5 | 10.1 | 5.0 | 115 | 73.6 | <0.2 | <2 |
| | | 11:39 | 4.7 | 9.9 | 5.0 | 115 | 73.8 | <0.2 | <2 |
| 8/15/2000 | | | | | | | | | |
| | LB-0728 | 11:04 | 0.5 | 21.3 | 4.6 | 120 | 76.6 | 6.1 | 67 |
| | | 11:10 | 1.5 | 20.3 | 4.6 | 115 | 73.5 | 2.8 | 30 |
| | | 11:17 | 2.5 | 14.8 | 5.2 | 122 | 78.3 | <0.2 | <2 |
| | | 11:23 | 3.5 | 11.9 | 5.2 | 122 | 78.1 | <0.2 | <2 |
| | | 11:29 | 4.5 | 10.5 | 5.2 | 118 | 75.4 | <0.2 | <2 |
| | | 11:35 | 5.0 | 10.2 | 5.2 | 118 | 75.4 | <0.2 | <2 |
| 9/20/2000 | | | | | | | | | |
| | LB-0817 | 11:37 | 0.5 | 20.1 | 4.8 | 124 | 79.3 | 7.1 | 77 |
| | | 11:42 | 1.5 | 19.6 | 4.8 | 125 | 79.9 | 6.5 | 70 |
| | | 11:48 | 2.4 | 15.8 | 5.2 | 128 | 82.0 | <0.2 | <2 |
| | | 11:57 | 3.5 | 11.7 | 5.3 | 122 | 77.8 | <0.2 | <2 |
| | | 12:02 | 4.5 | 10.7 | 5.3 | 119 | 75.9 | <0.2 | <2 |
| White Island Pond (Palis: 95166) | | | | | | | | | |
| Unique_ID: WO762 Station: A | | | | | | | | | |
| Description: deep hole in southern lobe of East Basin, Plymouth | | | | | | | | | |
| 7/19/2000 | | | | | | | | | |
| | LB-0656 | 10:02 | 0.5 | 24.4 | 6.4 | 49.4 | 31.6 | 7.8 | 92 |
| | | 10:11 | 1.4 | 24.3 | 6.3 | 49.3 | 31.6 | 7.6 | 89 |
| | | 10:17 | 2.5 | 24.2 | 6.3 | 49.1 | 31.4 | 7.2 | 85 |
| | | 10:23 | 3.4 | 24.2 | 6.2 | 49.1 | 31.4 | 7.2 | 84 |
| | | 10:30 | 3.9 | 24.2 | 6.2 | 49.2 | 31.5 | 7.1 | 83 |
| 8/16/2000 | | | | | | | | | |
| | LB-0747 | 14:13 | 0.5 | 22.7 | 6.8u | 46.9 | 30.0 | 9.0 | 103 |
| | | 14:17 | 1.5 | 22.7 | 6.7 | 46.9 | 30.0 | 8.9 | 101 |
| | | 14:22 | 2.5 | 22.7 | 6.7 | 46.9 | 30.0 | 8.8 | 101 |
| | | 14:26 | 3.7 | 22.7 | 6.6 | 47.1 | 30.1 | 8.5u | 96u |
| 9/20/2000 | | | | | | | | | |
| | LB-0836 | 12:57 | 0.5 | 21.2 | 7.3ci | 46.4 | 29.7 | 9.4 | 105 |
| | | 13:04 | 1.5 | 21.2 | 7.1ci | 46.4 | 29.7 | 9.3 | 103 |
| | | 13:10 | 2.5 | 21.1 | 6.6i | 46.4 | 29.7 | 9.0 | 100 |
| | | 13:16 | 3.5 | 21.0 | 6.0i | 47.0 | 30.1 | **u | **u |
| | | 13:23 | 4.0 | 20.7 | 5.8i | 48.1 | 30.8 | 5.2u | 57u |

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" u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc.

Table A2 (Continued). 2000 DEP DWM Buzzards Bay Watershed Baseline Lakes *In-situ* Hydrolab® Data

| Date | OWMID | Time (24hr) | Depth (m) | Temp (C) | pH (SU) | Cond@ 25C (uS/cm) | TDS (mg/l) | DO (mg/l) | SAT (%) |
|---|---------|----------------|--------------|-------------|------------|-------------------------|---------------|--------------|------------|
| White Island Pond (Palis: 95173) | | | | | | | | | |
| Unique_ID: WO754 Station: A | | | | | | | | | |
| Description: deep hole in northern lobe of West Basin, Plymouth | | | | | | | | | |
| 7/19/2000 | | | | | | | | | |
| | LB-0657 | 11:40 | 0.5 | 24.8 | 6.0 | 48.5 | 31.0 | 7.7 | 91 |
| | | 11:46 | 1.5 | 24.8 | 6.1 | 48.6 | 31.1 | 7.7 | 91 |
| | | 11:52 | 2.5 | 24.9 | 6.0 | 48.6 | 31.1 | 7.6 | 90 |
| | | 11:59 | 3.5 | 24.9 | 6.1 | 48.7 | 31.1 | 7.6 | 90 |
| 8/16/2000 | | | | | | | | | |
| | LB-0751 | 12:50 | 0.5 | 23.2 | 6.0 | 46.8 | 29.9 | 7.9 | 91 |
| | | 13:00 | 1.5 | 23.2 | 6.0 | 46.8 | 29.9 | 7.9 | 90 |
| | LB-0751 | 13:03 | 2.5 | 23.2 | 5.9 | 46.8 | 29.9 | 7.8 | 90 |
| | | 13:08 | 3.5 | 23.2 | 5.9 | 46.8 | 29.9 | 7.8 | 90 |
| | LB-0975 | 13:16m | 3.5m | 23.2m | 6.0m | 46.8m | 29.9m | 7.8m | 90m |
| | | 13:20m | 2.5m | 23.2m | 6.0m | 46.8m | 29.9m | 7.9m | 91m |
| | | 13:24m | 1.5m | 23.2m | 6.0m | 46.7m | 29.9m | 7.9m | 91m |
| | | 13:29m | 0.5m | 23.2m | 6.0m | 46.8m | 29.9m | 7.8m | 90m |
| 9/20/2000 | | | | | | | | | |
| | LB-1167 | 15:00 | 0.5 | 22.1 | 7.0u | 46.2 | 29.6 | 9.4 | 106 |
| | | 15:06 | 1.5 | 22.0 | 7.0 | 46.4 | 29.7 | 9.3 | 105 |
| | | 15:12 | 2.5 | 21.9 | 6.6 | 46.3 | 29.6 | 9.2 | 104 |
| | | 15:19 | 3.5 | 21.5 | 5.7 | 46.9 | 30.0 | 6.9u | 77u |
| Unnamed Tributary | | | | | | | | | |
| Unique_ID: WO791 Station: B, Mile Point: 0.01 | | | | | | | | | |
| Description: inlet to Crane Brook Bog Pond from unnamed tributary upstream/west of Route 58 at northwestern end of pond, Carver | | | | | | | | | |
| 7/13/2000 | | | | | | | | | |
| | LB-0671 | 14:54 | 0.5 | 25.5 | 5.9 | 62.5 | 40.0 | 8.2 | 98 |
| Unnamed Tributary | | | | | | | | | |
| Unique_ID: WO769 Station: B, Mile Point: -9 | | | | | | | | | |
| Description: inlet to White Island Pond [East Basin] from cranberry bog at eastern edge of northern lobe, Plymouth | | | | | | | | | |
| 9/20/2000 | | | | | | | | | |
| | No Flow | -- | -- | -- | -- | -- | -- | -- | -- |
| Unnamed Tributary | | | | | | | | | |
| Unique_ID: 786 Station: O, Mile Point: -9 | | | | | | | | | |
| Description: inlet to New Bedford Reservoir [North Basin] from cranberry bog at northern point of western lobe of New Bedford Reservoir [North Basin], Acushnet | | | | | | | | | |
| 8/15/2000 | | | | | | | | | |
| | No Flow | -- | -- | -- | -- | -- | -- | -- | -- |
| " ** " = Censored or missing data (i.e., data that should have been reported) " -- " = No data (i.e., data not taken/not required) " m " = method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed, i.e., operator error (e.g., less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented. " u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. | | | | | | | | | |

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Table A3. 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|--|---------------|------------------------|-------------------------|--|------------------------------------|----------------------------------|---|------------------------------|---|---|-------------------------------------|
| Federal Pond (Palis: 95055) | | | | | | | | | | | |
| Unique_ID: WO763 Station: A | | | | | | | | | | | |
| Description: deep hole between larger islands of southern lobe, Carver | | | | | | | | | | | |
| 7/20/2000 | 2.3 | 14:20 | 2.8 | LB-1025 LB-1026 LB-1027 LB-1028 LB-1029 | LB-1026 LB-1025 BLANK | ** ** ** ** ** | 0.5 0.5 -- 0 - 2.3 2.3 | <2 <2 <2 -- 2 | 0.011 0.012 <0.005 -- 0.027 | -- 23 -- -- -- | -- -- -- 8.7 -- |
| 8/16/2000 | >3.0 | 11:00 | 3.0 | LB-1067 LB-1068 LB-1069 LB-1070 LB-1071 LB-1072 | LB-1068 LB-1067 DUP BLANK | ** ** ** ** ** ** | 0.5 0.5 0.5 -- 0 - 2.5 2.5 | 4 4 3 2 -- 4 | 0.013b 0.010b 0.010b 0.006b -- 0.062 | 23 23 <15 <15 -- 17 | -- -- -- -- 7.4 h -- |
| 9/12/2000 | >2.8 | 12:17 | 2.8 | LB-1109 LB-1110 LB-1111 LB-1112 LB-1113 LB-1114 | LB-1110 LB-1109 DUP BLANK | ** ** ** ** ** ** | 0.5 0.5 0.5 -- 2.3 0 - 2.3 | 3 3 4 <2 4 -- | 0.007 0.007 0.007 <0.005 0.037 -- | <15b <15b 46b 23b 46b -- | -- -- -- -- -- 5.9 |

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"--" = No data (i.e., data not taken/not required)
"h" = holding time violation (usually indicating possible bias low)

Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|---|---------------|------------------------|-------------------------|---|----------------|--------------|-----------------------------------|------------------------------|--|------------------------------|-------------------------------|
| New Bedford Reservoir (Palis: 95110) Unique_ID: WO781 Station: A | | | | | | | | | | | |
| Description: deep hole in southeast end of North Basin, Acushnet | | | | | | | | | | | |
| 7/18/2000 | 1.1 | 16:29 | 2.4 | LB-0635 LB-0636 LB-0637 | | ** | 0.5 2.0 0 - 2.0 | 12 11 -- | 0.070 0.070 -- | 140 150 -- | -- -- 4.1 |
| 8/15/2000 | 1.5 | 14:54 | 2.8 | LB-0730 LB-0731 LB-0732 | | ** | 0.5 2.3 0 - 2.3 | 12 13 -- | 0.042 0.031 -- | 160 140 -- | -- -- 8.7 |
| 9/19/2000 | 2.2 | 11:37 | ** | LB-0820 LB-0821 LB-1137 LB-1138 LB-1139 | AUDIT AUDIT | ** | **m **m -- -- 0 - 2.0 | 16m 12m -- -- -- | 0.021m 0.025m 0.032 0.025 -- | 65m 49m -- -- -- | -- -- -- -- 5.8 h |
| New Bedford Reservoir (Palis: 95110) Unique_ID: WO782 Station: B | | | | | | | | | | | |
| Description: deep hole in southern end of South Basin, Acushnet | | | | | | | | | | | |
| 7/20/2000 | 1.5 | 10:55 | 4.6 | LB-0882 | | ** | 0.5 | 0.058m | -- | -- | -- |
| 8/15/2000 | 1.8 | 16:40 | 4.5 | LB-0950 LB-0951 LB-1163 | | ** | 0.5 4.0 0 - 4.0 | 0.028 0.031 -- | 80 85 -- | -- -- -- | -- -- 7.4 |
| 9/19/2000 | 2.1 | 12:50 | 4.2 | LB-0828 | | ** | **m | 0.018m | -- | -- | -- |
| New Bedford Reservoir (Palis: 95110) Unique_ID: WO783 Station: C | | | | | | | | | | | |
| Description: deep hole in southeast end of East Basin, Acushnet | | | | | | | | | | | |
| 7/20/2000 | 1.7 | 10:11 | 2.1 | LB-0881 | | ** | 0.5 | 0.047m | -- | -- | -- |
| 8/15/2000 | >2.1 | 12:45 | 2.1 | LB-0734 LB-0735 LB-0736 | | ** | 0.5 1.5 0 - 1.5 | 0.016 0.021 -- | 60 60 -- | -- -- -- | -- -- 35.6 h |
| 9/19/2000 | 1.5 | 13:50 | ** m | LB-0827 | | ** | **m | 0.044m | -- | -- | -- |

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 "h" = holding time violation (usually indicating possible bias low)
 "m" = method SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g., sediment in sample, floc formation), lab error (e.g., cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, and missing data.

Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|---|---------------|------------------------|-------------------------|--|--|--|---|--|---|--|--|
| New Long Pond (Palis: 95112) Unique_ID: WO780 Station: A | | | | | | | | | | | |
| Description: deep hole center of pond, Plymouth | | | | | | | | | | | |
| 7/13/2000 | >1.7 | 11:30 | 1.7 | LB-0665 LB-0666 LB-0667 LB-0668 LB-0669 | LB-0666 LB-0665 | ** ** ** ** 13:00 | 0.5 0.5 1.3 0 - 1.0 -- | <2 <2 <2 -- <2 | 0.008 0.007 0.008 -- <0.005 | <15 <15 <15 -- <15 | -- -- -- <1.0 -- |
| 8/17/2000 | ** m | 11:10 | 2.5m | LB-0764 LB-0765 LB-0766 LB-0888 LB-0889 LB-0890 | BLANK LB-0889 LB-0888 DUP | ** ** ** ** ** ** | -- 1.2 **m 0.5 0.5 0.5 | <2 2 -- 3 2 <2 | <0.005 0.008 -- 0.006 0.006 0.007 | <15h 20h -- 16h 18h 18h | -- -- <1.0 m -- -- -- |
| 9/14/2000 | >1.6 | 13:30 | 1.6 | LB-0855 LB-0856 LB-0857 LB-0858 LB-0859 LB-0860 LB-0861 LB-1133 | LB-0856 LB-0855 DUP BLANK AUDIT AUDIT | ** ** ** ** ** ** ** ** | 0.5 0.5 0.5 -- -- 0 - 1.1 -- 1.1 | <2 <2 <2 <2 -- -- -- -- | 0.006 0.006 0.006 <0.005 0.026 -- 0.024 <0.005 | <15 <15 <15 <15 -- -- -- -- | -- -- -- -- -- <1.0 h -- -- |

"**" = Censored or missing data (i.e., data that should have been reported)

"--" = No data (i.e., data not taken/not required)

"h" = holding time violation (usually indicating possible bias low)

"m" = method SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g., sediment in sample, floc formation), lab error (e.g., cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, and missing data.

Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|--|---------------|------------------------|-------------------------|---------|---------|--------------|---------------------|----------------------|----------------------------|------------------|--------------------------|
| Parker Mills Pond (Palis: 95115) Unique_ID: WO776 Station: A | | | | | | | | | | | |
| Description: deep hole in southern end, Wareham | | | | | | | | | | | |
| 7/20/2000 | 1.8 | 11:20 | 3.2 | LB-1034 | | ** | 0.5 | 7 | 0.054 | 65 | -- |
| | | | | LB-1035 | | ** | 2.5 | 6 | 0.098 | 75 | -- |
| | | | | LB-1036 | | ** | 0 - 2.5 | -- | -- | -- | 12.1 |
| 8/16/2000 | 2.1 | 13:20 | 3.2 | LB-1077 | | ** | 0.5 | 6 | 0.048 | 25 | -- |
| | | | | LB-1078 | | ** | 2.7 | 6 | 0.052 | 40 | -- |
| | | | | LB-1079 | | ** | 0 - 2.7 | -- | -- | -- | 3.0 |
| 9/12/2000 | 2.2 | 10:03 | 2.6 | LB-1117 | | ** | 0.5 | 6 | 0.030 | 32 | -- |
| | | | | LB-1118 | | ** | 2.1 | 5 | 0.041 | 25 | -- |
| | | | | LB-1119 | | ** | 0 - 2.1 | -- | -- | -- | 5.8 h |
| Turner Pond (Palis: 95151) Unique_ID: WO774 Station: B | | | | | | | | | | | |
| Description: deep hole in eastern lobe of western basin, New Bedford | | | | | | | | | | | |
| 7/18/2000 | 0.6 | 13:30 | 3.9 | LB-0630 | | ** | 0.5 | <2 | 0.057 | 320 | -- |
| | | | | LB-0631 | | ** | 3.5 | 6 | 0.29 | 150 | -- |
| | | | | LB-0632 | | ** | 0 - 1.8 | -- | -- | -- | <1.0 |
| 8/15/2000 | 0.6 | 10:07 | 3.8 | LB-0718 | LB-0719 | ** | 0.5 | 2 | 0.030b | 280 | -- |
| | | | | LB-0719 | LB-0718 | ** | 0.5 | 2 | 0.027b | 280 | -- |
| | | | | LB-0720 | DUP | ** | 0.5 | 2 | 0.032b | 250 | -- |
| | | | | LB-0721 | BLANK | ** | -- | <2 | 0.007b | <15 | -- |
| | | | | LB-0722 | | ** | 3.3 | 5 | 0.28 b | 380 | -- |
| | | | | LB-0723 | | ** | 0 - 1.8 | -- | -- | -- | 9.4 |
| 9/20/2000 | 0.7 | 13:55 | 2.0 | LB-0818 | | ** | **m | -- | 0.033 | -- | -- |

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Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|---|---------------|------------------------|-------------------------|---|------------------------------------|--|--|---------------------------------------|--|---|--|
| Turner Pond (Palis: 95151) Unique_ID: WO775 Station: A | | | | | | | | | | | |
| Description: deep hole in southeastern lobe of eastern basin, New Bedford | | | | | | | | | | | |
| 7/18/2000 | 0.5 | 12:05 | 5.3 | LB-0621 LB-0622 LB-0623 LB-0628 LB-0629 | LB-0623 LB-0622 BLANK | ** ** ** ** 12:05 | 0.5 4.6 4.6 -- 0 - 1.5 | <2 3 3 <2 -- | 0.055 0.097 0.10 <0.005 -- | 320 300 320 <15 -- | -- -- -- -- 1.0 |
| 8/15/2000 | 0.6 | 11:00 | 5.5 | LB-0725 LB-0726 LB-0727 | | ** ** ** | 0.5 **m 0 - 1.8 | <2 5m -- | 0.027 0.078m -- | 320 320m -- | -- -- 1.2 |
| 9/20/2000 | 0.5 | 11:30 | 6.0 | LB-0811 LB-0812 LB-0813 LB-0814 LB-0815 LB-0816 LB-1136 | LB-0812 LB-0811 DUP BLANK | ** ** ** ** ** ** ** | 0.5 0.5 0.5 0.5 0 - 1.5 5.0 -- | <2 <2 <2 <2 -- 8 -- | 0.032d 0.024d 0.026 <0.005 -- 0.12 0.025 | 230 230 280 <15 -- 280 -- | -- -- -- -- <1.0 h -- -- |

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Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | | Secchi | Secchi Time | Station Depth | OWMID | QAQC | Time | Sample Depth | Alkalinity | Total Phosphorus | DWM Color | Chlorophyll a |
|---|-----|--------|-------------|---------------|---------|---------|------|--------------|------------|------------------|-----------|---------------|
| | | (m) | 24hr | (m) | | | 24hr | (m) | (mg/l) | (mg/l) | PCU | (mg/m3) |
| White Island Pond (Palis: 95166) Unique_ID: WO762 Station: A | | | | | | | | | | | | |
| Description: deep hole in southern lobe of East Basin, Plymouth | | | | | | | | | | | | |
| 7/19/2000 | 1.2 | 10:30 | 4.5 | | LB-0645 | LB-0646 | ** | 0.5 | 3 | 0.12 | -- | -- |
| | | | | | LB-0646 | LB-0645 | ** | 0.5 | 4 | 0.098 | -- | -- |
| | | | | | LB-0647 | BLANK | ** | -- | <2 | <0.005 | -- | -- |
| | | | | | LB-0648 | | ** | 0 - 3.6 | -- | -- | -- | ** m |
| | | | | | LB-0649 | | ** | **m | 4m | 0.099m | -- | -- |
| 8/16/2000 | 1.1 | 14:07 | 4.3 | | LB-0738 | LB-0739 | ** | 0.5 | 4 | 0.085 | -- | -- |
| | | | | | LB-0739 | LB-0738 | ** | 0.5 | 4 | 0.084 | -- | -- |
| | | | | | LB-0740 | DUP | ** | 0.5 | 4 | 0.093 | -- | -- |
| | | | | | LB-0741 | | ** | 3.7 | 4 | 0.089 | -- | -- |
| | | | | | LB-0742 | BLANK | ** | -- | <2 | <0.005 | -- | -- |
| | | | | | LB-0743 | | ** | 0 - 3.7 | -- | -- | -- | 35.4 |
| 9/20/2000 | 1.1 | 12:35 | 4.5 | | LB-0831 | BLANK | ** | -- | <2 | <0.005 | <15 | -- |
| | | | | | LB-0832 | LB-0833 | ** | **m | 2 | 0.077 | 23 | -- |
| | | | | | LB-0833 | LB-0832 | ** | **m | 2 | 0.077 | 23 | -- |
| | | | | | LB-0834 | | ** | **m | 2m | 0.080m | 17m | -- |
| | | | | | LB-0835 | | ** | 0 - 4.0 | -- | -- | -- | 35.5 h |
| White Island Pond (Palis: 95173) Unique_ID: WO754 Station: A | | | | | | | | | | | | |
| Description: deep hole in northern lobe of West Basin, Plymouth | | | | | | | | | | | | |
| 7/19/2000 | 2.0 | 11:45 | 4.0 | | LB-0652 | | ** | 0.5 | 2 | 0.076 | -- | -- |
| | | | | | LB-0653 | | ** | 3.5 | <2 | 0.048 | -- | -- |
| | | | | | LB-0654 | | ** | 0 - 3.5 | -- | -- | -- | 5.7 |
| 8/16/2000 | 2.2 | 12:30 | 4.0 | | LB-0748 | | ** | 0.5 | 4 | 0.038 | -- | -- |
| | | | | | LB-0749 | | ** | 3.5 | 3 | 0.037 | -- | -- |
| | | | | | LB-0750 | | ** | 0 - 3.5 | -- | -- | -- | 11.8 |
| 9/20/2000 | 1.3 | 14:30 | 4.0 | | LB-0849 | | ** | 0.5 | <2 | 0.038 | <15 | -- |
| | | | | | LB-1165 | | ** | 3.5 | 2 | 0.037 | <15 | -- |
| | | | | | LB-1166 | | ** | 0 - 3.5 | -- | -- | -- | 13.1 h |

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Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m ³) |
|---|---------------|------------------------|-------------------------|---------|------|--------------|------------------------|----------------------|----------------------------|------------------|---------------------------------------|
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO778 Station: C, Mile Point: 0.1 | | | | | | | | | | | |
| Description: inlet to Parker Mills Pond at Tihonet Road (from cranberry bog entering western lobe of northern end), Wareham | | | | | | | | | | | |
| 7/20/2000 | -- | -- | -- | LB-1038 | | ** | -- | -- | 0.019 | -- | -- |
| 8/16/2000 | -- | -- | -- | LB-1150 | | ** | -- | 4 | 0.046 | 23 | -- |
| 9/12/2000 | -- | -- | -- | LB-1121 | | ** | -- | -- | 0.029 | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO791 Station: B, Mile Point: 0.01 | | | | | | | | | | | |
| Description: inlet to Crane Brook Bog Pond from unnamed tributary upstream/west of Route 58 at northwestern end of pond, Carver | | | | | | | | | | | |
| 7/13/2000 | -- | -- | -- | LB-0670 | | ** | -- | 4 | 0.11 | 70d | -- |
| 8/10/2000 | -- | -- | -- | LB-0760 | | ** | -- | 7 | 0.11 | 60h | -- |
| 9/14/2000 | -- | -- | -- | LB-0852 | | ** | -- | -- | 0.056 | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO769 Station: B, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to White Island Pond [East Basin] from cranberry bog at eastern edge of northern lobe, Plymouth | | | | | | | | | | | |
| 7/19/2000 | -- | -- | -- | LB-0650 | | ** | -- | -- | 0.11 | -- | -- |
| 8/16/2000 | -- | -- | -- | LB-0744 | | ** | -- | -- | 0.31 | -- | -- |
| 9/20/2000 | -- | -- | -- | No Flow | | -- | -- | -- | -- | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO770 Station: C, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to White Island Pond [East Basin] from cranberry bog at northwestern edge of northern lobe, Plymouth | | | | | | | | | | | |
| 7/19/2000 | -- | -- | -- | LB-0651 | | ** | -- | -- | 0.068 | -- | -- |
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Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|--|---------------|------------------------|-------------------------|---------|---------|--------------|------------------------|----------------------|----------------------------|------------------|--------------------------|
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO771 Station: D, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to White Island Pond [East Basin] from cranberry bog at western edge of northern lobe, Plymouth | | | | | | | | | | | |
| 8/16/2000 | -- | -- | -- | LB-0745 | | ** | -- | -- | 0.18 | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO772 Station: F, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to White Island Pond [East Basin] from cranberry bog at northern edge of northern lobe, Plymouth | | | | | | | | | | | |
| 9/20/2000 | -- | -- | -- | LB-0837 | | ** | -- | -- | 1.4 | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO773 Station: G, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to White Island Pond [East Basin] from cranberry bog at southern edge, Wareham | | | | | | | | | | | |
| 7/19/2000 | -- | -- | -- | | LB-0655 | | ** | -- | 0.066 | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO777 Station: B, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to Parker Mills Pond from cranberry bog at western edge of southern end, approximately 30 feet upstream of pond, Wareham | | | | | | | | | | | |
| 7/20/2000 | -- | -- | -- | | LB-1037 | | ** | -- | 0.10 | -- | -- |
| 8/16/2000 | -- | -- | -- | | | | | -- | | | |
| 9/12/2000 | -- | -- | -- | | LB-1151 | | ** | -- | 6 | 65 | -- |
| | | | | | LB-1120 | | ** | -- | 2.5 | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO785 Station: N, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to New Bedford Reservoir [North Basin] from cranberry bog at northern edge of western lobe of New Bedford Reservoir [North Basin], Acushnet | | | | | | | | | | | |
| 8/15/2000 | -- | -- | -- | | | | | -- | | | |
| 9/19/2000 | -- | -- | -- | | LB-0954 | | ** | -- | 0.017 | -- | -- |
| | | | | | LB-0823 | | ** | -- | 0.11 m | -- | -- |

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Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|---|------------|------------------|-------------------|---------|---------|-----------|------------------|-------------------|-------------------------|---------------|-----------------------|
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO786 Station: O, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to New Bedford Reservoir [North Basin] from cranberry bog at northern point of western lobe of New Bedford Reservoir [North Basin], Acushnet | | | | | | | | | | | |
| 8/15/2000 | -- | -- | -- | No Flow | | | -- | -- | -- | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO787 Station: Q, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to New Bedford Reservoir [North Basin] from unnamed tributary to northwestern lobe of New Bedford Reservoir [North Basin], | | | | | | | | | | | |
| 7/20/2000 | 1.4 | 13:16 | -- | | LB-0887 | BLANK | ** | -- | <0.005 | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO788 Station: R, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to New Bedford Reservoir [North Basin] from cranberry bog at western edge of New Bedford Reservoir [North Basin], Acushnet | | | | | | | | | | | |
| 8/15/2000 | -- | -- | -- | | | | -- | -- | -- | -- | -- |
| 9/19/2000 | -- | -- | -- | | LB-0955 | | ** | -- | 0.52 | -- | -- |
| | | | | | LB-0824 | | ** | -- | 0.55 m | -- | -- |
| Unnamed Tributary | | | | | | | | | | | |
| Unique_ID: WO789 Station: S, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to New Bedford Reservoir [South Basin] from cranberry bog near northeastern corner of New Bedford Reservoir [South Basin], Acushnet | | | | | | | | | | | |
| 7/20/2000 | -- | -- | -- | | | | -- | -- | -- | -- | -- |
| 8/15/2000 | -- | -- | -- | | LB-0883 | | ** | -- | ** m | -- | -- |
| 9/19/2000 | -- | -- | -- | | LB-0952 | | ** | -- | 0.13 | -- | -- |
| | | | | | LB-0829 | | ** | -- | 0.25 m | -- | -- |
| ROSE BROOK (Saris: 9558825) | | | | | | | | | | | |
| Unique_ID: WO779 Station: D, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to Parker Mills Pond from cranberry bog/Rose Brook upstream/west of Tihonet Road, Wareham. (Rose Brook runs through cranberry bogs.) | | | | | | | | | | | |
| 7/20/2000 | -- | -- | -- | | | | -- | -- | -- | -- | -- |
| 8/16/2000 | -- | -- | -- | | LB-1039 | | ** | -- | 0.056 | -- | -- |
| 9/12/2000 | -- | -- | -- | | LB-1152 | | ** | -- | 0.030 | 25 | -- |
| | | | | | LB-1122 | | ** | -- | 0.009 | -- | -- |

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Table A3 (Continued). 2000 DWM Buzzards Bay Watershed Baseline Lakes Physico-chemical Data.

| Date | Secchi (m) | Secchi Time 24hr | Station Depth (m) | OWMID | QAQC | Time 24hr | Sample Depth (m) | Alkalinity (mg/l) | Total Phosphorus (mg/l) | DWM Color PCU | Chlorophyll a (mg/m3) |
|---|---|---------------------|----------------------|-------|---------|--------------|---------------------|----------------------|----------------------------|------------------|--------------------------|
| KEENE RIVER (Saris: 9559675) | | | | | | | | | | | |
| Unique_ID: WO784 Station: M, Mile Point: -9 | | | | | | | | | | | |
| Description: inlet to New Bedford Reservoir [North Basin] from cranberry bog/Keene River at northwest corner of New Bedford Reservoir [North Basin], Acushnet. (Keene River runs through cranberry bogs.) | | | | | | | | | | | |
| 9/19/2000 | -- | -- | -- | | LB-0825 | | ** | -- | 0.028m | -- | -- |
| " * " = | Censored or missing data (i.e., data that should have been reported) | | | | | | | | | | |
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APPENDIX B

MA DEP OWM/DWM FISH TOXICS MONITORING IN THE BUZZARDS BAY WATERSHED

1995 AND 2000

INTRODUCTION

Fish toxics monitoring is a cooperative effort between three Massachusetts Department of Environmental Protection Offices/Divisions- Watershed Management, Research and Standards (ORS), and Environmental Analysis (Wall Experiment Station- WES), the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE), and the Massachusetts Department of Public Health (MDPH). Fish toxics monitoring is typically conducted to assess the concentrations of toxic contaminants in freshwater fish, identify waterbodies where those concentrations may pose a risk to human health, and identify waters where toxic contaminants may impact fish and other wildlife.

Between September 1995 and August 2000, fish were collected by the DEP Office of Watershed Management (OWM)/Division of Watershed Management (DWM) at four sites in the Buzzards Bay Watershed as follows: Snipatuit Pond, Rochester in September 1995, Glen Charlie Pond, Wareham in October 1995, Noquochoke Lake, Dartmouth and White Island Pond, Plymouth in August 2000.

PROJECT OBJECTIVES

Fish tissue monitoring is typically conducted to assess the levels of toxic contaminants in freshwater fish, identify waterbodies where those levels may impact human health, and identify waters where toxic chemicals may impact fish and other aquatic life. Nonetheless, human health concerns have received higher priority and, therefore, fish tissue analysis has been restricted to edible fillets. The fish toxics monitoring was designed to screen the edible fillets of several species of fish representing different feeding groups (i.e., bottom dwelling omnivores, top-level predators, etc.) for the presence of heavy metals, Polychlorinated biphenyls (PCBs) and chlorinated pesticides. In 2000, MA DEP DWM Fish Toxics Monitoring was conducted under an EPA-approved Fish Toxics Quality Assurance Project Plan CN 0037.0. Data Quality Objectives are presented in the above-mentioned QAPP. There were no deviations from the QAPP.

METHODS

Uniform protocols, designed to assure accuracy and prevent cross-contamination of samples, were followed for collecting, processing, and shipping fish collected for the fish toxics monitoring. In 1995 fish were collected on 14 September from Snipatuit Pond, Rochester and on 5 October from Glen Charlie Pond, Wareham. In 2000, fish were collected from White Island Pond, Plymouth on 21 August and Noquochoke Lake, Dartmouth on 28 August. All fish were collected using boat-mounted electroshocking gear and/or gill nets. Fish selected for analysis were placed in an ice filled cooler and brought back to the OWM/DWM laboratory for processing. Processing included measuring lengths and weights and visually inspecting fish for tumors, lesions, or other indications of stress or disease. Scales, spines, or pectoral fin ray samples were obtained from each sample to determine the approximate age of the fish. Fish were filleted (skin off) with stainless steel knives on glass cutting boards.

1995 FISH TOXICS

Details related to the collection, handling, and processing of samples were excerpted from the report entitled *1995 Public Request Fish Toxics Monitoring Surveys* (Maietta 1995).

Fillets targeted for metals analysis were placed in VWR high density polyethylene (HDPE) cups with covers. The opposite fillets were wrapped in aluminum foil for % lipids, PCB and organochlorine pesticide analysis. In the case of composite samples, two or three fillets from like-sized individuals of the same species were wrapped together in aluminum foil or stored in the single sample container. Samples were tagged and frozen

for subsequent delivery to WES. All equipment used in the filleting and storage process was rinsed in accordance with USEPA procedures (1993). Methods used at WES for metals analysis include a cold vapor method using a VGA hydride generator for mercury and Varian 1475 flame atomic absorption for all remaining metals. PCB/organochlorine pesticide analysis was performed on a gas chromatograph equipped with an electron capture detector.

2000 FISH TOXICS

Details related to the collection, handling, and processing of samples were excerpted from the report entitled *2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys* (Maietta and Colonna-Romano 2000).

All equipment used in the filleting process was rinsed in tap water and then rinsed twice in de-ionized water before and or after each sample. Samples (individual or composite) targeted for % lipids, PCBs and organochlorine pesticide analysis were wrapped in aluminum foil. Samples targeted for metals analysis were placed in VWR 32-ounce high density polyethylene (HDPE) cups with covers. Composite samples ranged from two to five fillets from like-sized individuals of the same species (occasionally the same genus). Samples were tagged and frozen for subsequent delivery to the Department's Wall Experiment Station (WES).

Methods used at WES for metals analysis include the following:

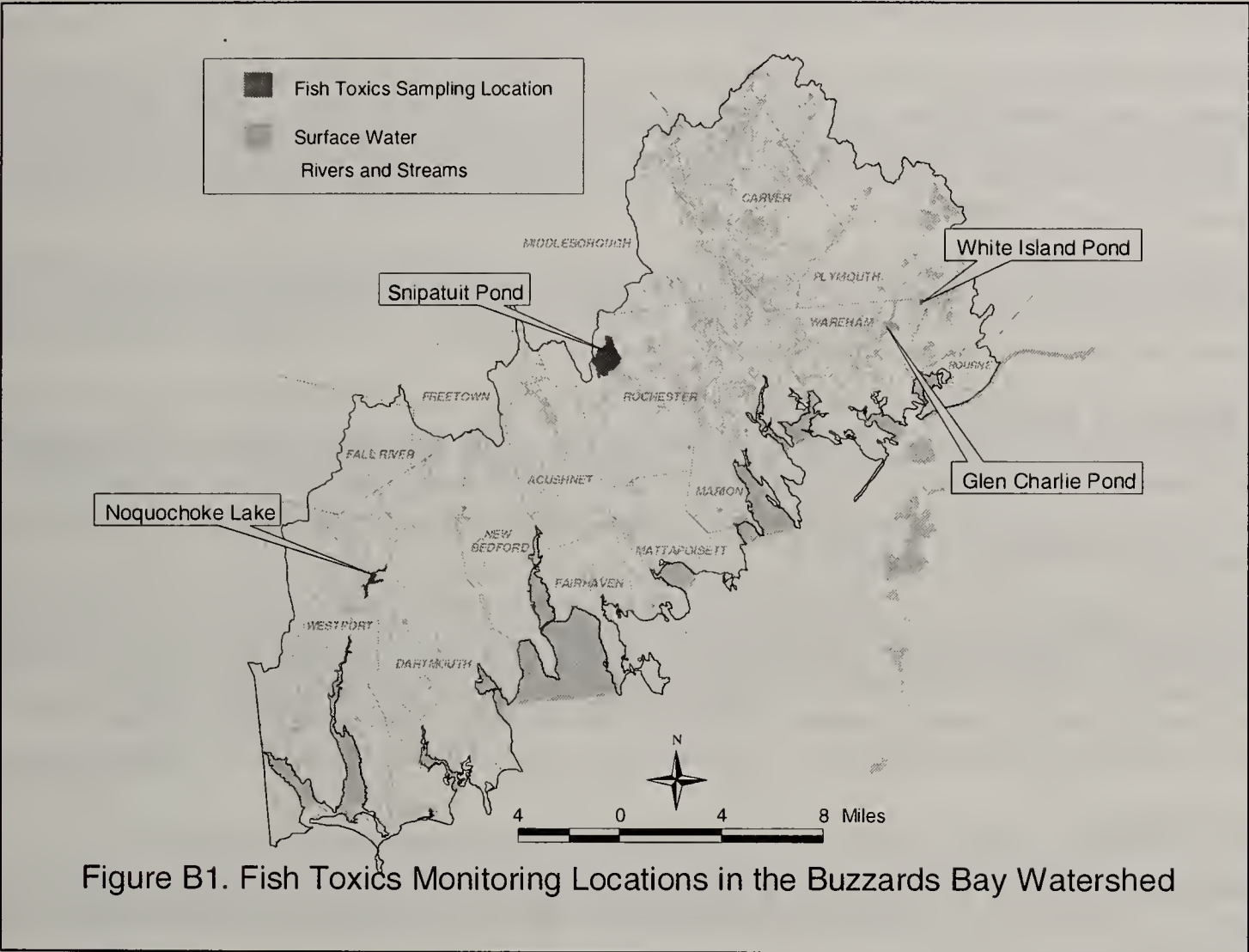
Mercury is analyzed by a cold vapor method using a Perkin Elmer, FIMS (Flow Injection Mercury System), which uses Flow Injection Atomic Absorption Spectroscopy. Cadmium and lead are analyzed using a Perkin Elmer, Optima 3000 XL ICP - Optical Emission Spectrophotometer. Arsenic and selenium are analyzed using a Perkin Elmer, Zeeman 5100 PC, Platform Graphite Furnace, Atomic Absorption Spectrophotometer.

PCB Arochlor, PCB congener, and organochlorine pesticide analysis was performed on a gas chromatograph equipped with an electron capture detector "according to the modified AOAC 983.21 procedure for the analysis of PCB Arochlors, Congeners, and Organochlorine Pesticides."

According to standard practice, all laboratory analytical results were forwarded to the Massachusetts Department of Public Health.

RESULTS

The results of MA DEP Buzzards Bay Watershed fish toxics monitoring surveys are described below for each sampling event (MA DEP 1995, MA DEP 2000, Maietta 1995, and Maietta and Colonna-Romano 2000). Data for all surveys are presented in Tables 3-1 through 3-4. Sampling locations are depicted in Figure B1. All raw data files, field sheets, lab reports, chain of custody forms, and other metadata are maintained in open files and databases at the MA DEP DWM in Worcester. Quality Assurance Data is available in *Data Validation Report for Year 2000 Project Data (CN 083.0) DRAFT December 19, 2002*.



1995 FISH TOXICS

Snipatuit Pond, Rochester

Fish collected and retained for analysis from Snipatuit Pond included American eel (*Anguilla rostrata*), bluegill (*Lepomis macrochirus*), brown bullhead (*Ameiurus nebulosus*), black crappie (*Pomoxis nigromaculatus*), chain pickerel (*Esox niger*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), and yellow perch (*Perca flavescens*). Three-fillet composites of largemouth bass, black crappie, American eel and yellow perch were analyzed at the Wall Experiment Station for cadmium, lead, mercury, arsenic, selenium, percent lipids, PCB arochlors and congeners, and pesticides. Two pumpkinseed fillets and one bluegill fillet were composited and analyzed for metals and organics. Individual samples of brown bullhead and chain pickerel were also submitted to WES. The brown bullhead sample was analyzed for organics only and the chain pickerel sample was analyzed for metals only.

Mercury in the fish tissue from Snipatuit Pond ranged from 0.224 to 0.579 mg/kg wet weight. The mercury data triggered a site-specific advisory against the consumption of fish from Snipatuit Pond (*"Children younger than 12 years, pregnant women, and nursing mothers should not eat fish from this water body." "The general public should limit consumption of black crappie and largemouth bass from this water body to two meals per month."* MDPH 2002).

Selenium levels ranged from 0.206 to 0.688 mg/kg wet weight. Lipid concentrations ranged from 0.16% to 0.62%. PCB arochlors and congeners, pesticides, cadmium, arsenic, and lead were not detected in the edible fillets of all samples analyzed from Snipatuit Pond.

Glen Charlie Pond, Wareham

American eel, bluegill, largemouth bass, yellow perch, and white perch (*Morone americana*) were collected from Glen Charlie Pond for fish toxics analysis. Three-fillet composites of largemouth bass, yellow perch, American eel, and bluegill were analyzed at WES for metals and organics. An individual white perch sample was also analyzed for metals and organics.

Mercury in the fish tissue ranged from 0.252 to 0.740 mg/kg wet weight. The 0.740 mg/kg, from an individual white perch sample, slightly exceeded the MDPH trigger level of 0.50 mg/kg, however, MDPH does not issue an advisory based on an individual sample. With the exception of the white perch sample, which contained 0.0470 mg/kg of arsenic, arsenic, PCB arochlors and congeners, pesticides, cadmium, and lead were not detected in the edible fillets. Selenium levels ranged from 0.069 to 0.112 mg/kg.

2000 FISH TOXICS

The results of MA DEP 2000 Buzzards Bay Watershed fish toxics monitoring surveys described below are excerpted from *2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys* (Maietta and Colonna-Romano 2000).

Noquochoke Lake

This 124-acre lake is located within the Buzzards Bay Watershed in Dartmouth. An impoundment of the Shingle Island River, Noquochoke Lake is downstream from a{n} EPA Superfund site (Re-Solve Site) which is located in the Copicut River subwatershed.

Noquochoke Lake was first sampled by DEP in 1988 as part of an assessment of the Re-Solve Superfund site. As a result of elevated mercury concentrations in 9 of 10 samples analyzed (multiple species) and elevated PCBs in an American eel, the following fish consumption advisory is currently in effect for Noquochoke Lake. It should be noted that mercury is not a site related contaminant. *"Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body." "The general public should not consume any largemouth bass or American eel from this water body." "The general public should limit consumption of all other fishes from this water body to two meals per month (MDPH 2002)."*

Electrofishing and gillnetting at Noquochoke Lake in Dartmouth in 2000 resulted in the collection of three largemouth bass, three yellow perch, three bluegill, and three black crappie.

Although mercury concentrations were lower in 2000, two of the four samples analyzed in 2000 exceeded the MDPH "trigger level" of 0.50 mg/kg. Due to the small number of samples analyzed during the two surveys it is impossible to ascertain whether mercury concentrations are actually decreasing in fishes from this water body.

Cadmium, lead, and arsenic were below MDLs {Method Detection Limits}. Selenium concentrations were consistent with those found in other water bodies within the Commonwealth and do not appear to be of concern.

PCBs and organochlorine pesticides were below MDLs in four samples analyzed from Noquochoke Lake. {MDLs can be found in Table 2 in *2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys*.}

White Island Pond

This 294-acre Eutrophic Pond is located within the Buzzards Bay watershed in the Town of Plymouth. There are a number of cranberry bogs located on the northern and southern shores of this water body. Shoreline development is moderate to heavy.

Electrofishing and gillnetting at White Island Pond resulted in the collection of three large mouth bass, three smallmouth bass *Micropterus dolomieu*, three yellow perch, three pumpkinseed, three white perch, and three brown bullhead.

Mercury was below the MDPH trigger level of 0.5 mg/kg in all six samples. Cadmium, lead, and arsenic were below MDLs in all samples analyzed. Selenium concentrations were consistent with those found in other water bodies within the Commonwealth and do not appear to be of concern.

PCB toxic congener BZ#77 (0.0021 mg/kg) was detected in a composite of white perch (Wif00-13-15) from White Island Pond. Although concentrations of this congener appear to be low, the MA DEP ORS and the MDPH are in the process of assessing the potential implications of various concentrations of congeners. PCBs Arochlors, congeners, and organochlorine pesticides were below method detection limits (MDLs) in the remaining five samples analyzed. {MDLs can be found in Table 2 in *2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys*.}

SUMMARY

Fish toxics monitoring in the Buzzards Bay Watershed in 1995 and 2000 resulted in site-specific fish consumption advisories for one of the waterbodies sampled and the collection of additional data for a waterbody previously listed on the MDPH fish consumption advisory list.

While one sample of fish tissue collected from Glen Charlie Pond, Wareham indicated elevated levels of mercury, MDPH does not issue site-specific advisories based on elevated concentrations in individual samples. Additional sampling should be conducted in Glen Charlie Pond to determine if a site-specific fish consumption advisory is warranted.

Annual monitoring of fish from Copicut River and Cornell Pond continues; since 1998, EPA has hosted an annual fishing derby at Cornell Pond to ensure appropriate fish species were collected under the Re-Solve Superfund site's environmental monitoring program. The fishing derbies have been held in September or October, and tap into the experience of local fishermen to collect fish from the pond. The derbies actively and safely involve the community in an important fish-monitoring program, and provide EPA an opportunity to re-emphasize the Massachusetts Department of Public Health Fish Advisory not to consume American eel and limit consumption of other fish species caught from the pond or river (EPA 13 December 2003). Additional monitoring of Noquochoke Lake is not conducted/required under the environmental monitoring program.

REFERENCES

- EPA. 13 December 2002. EPA New England National Priorities List (NPL) Fact Sheet Re-Solve Inc., North Dartmouth, MA [Online]
http://yosemite.epa.gov/r1/npl_pad.nsf/f6ec47ff9443008f85256aca004f000f/904132284a8a1e5a8525691f0063f6ef?OpenDocument . 31 January 2003.
- MA DEP. 1995. Open File. *1995 Fish Toxics Monitoring Data in the Buzzards Bay Watershed*. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
- MA DEP. 2000. Open File. *2000 Fish Toxics Monitoring Data in the Buzzards Bay Watershed*. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.
- MA DEP. 2002. CN 83.0. *Fish Contaminant Monitoring Program, Quality Assurance Project Plan, 2000*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.
- Maietta, R. J. 1995. *1995 Public Request Fish Toxics Monitoring Surveys (TM-S-4)*. Massachusetts Department of Environmental Protection, Office of Watershed Management. Worcester, MA
- Maietta, R. J. and J. Colonna-Romano. 2000. *2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys (TM-S-13)*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA
- MDPH. 2002. *Freshwater Fish Consumption Advisory List*. Massachusetts Department of Public Health. Boston, MA.

Table B1. 2000 DEP DWM Buzzards Bay Watershed Fish Toxics Monitoring Data excerpted from 2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys (Maietta and Colonna-Romano 2000). Results, reported in wet weight, are from individual fish filets with skin off.

| Sample ID | Collection Date | Species Code ¹ | Length (cm) | Weight (g) | Sample ID (laboratory sample #) | Cd (mg/kg) | Pb (mg/kg) | Hg (mg/kg) | As (mg/kg) | Se (mg/kg) | % Lipids (%) | PCB Aroclors and Congeners (µg/g) | Pesticides (µg/g) |
|---|--|---------------------------|-------------|------------|--|------------|------------|------------|------------|------------|--------------|-----------------------------------|-------------------|
| Noquochoke Lake, Dartmouth, Buzzards Bay Watershed | | | | | | | | | | | | | |
| NOF00-01 | 8/28/00 | LMB | 36.6 | 650 | 2000051 (L2000345-1 metals) | <0.02 | <0.20 | 0.43 | <0.04 | 0.16 | 0.18 | ND | ND |
| NOF00-02 | 8/28/00 | LMB | 35.5 | 700 | (L2000352-1 organics) | | | | | | | | |
| NOF00-03 | 8/28/00 | LMB | 35.5 | 720 | | | | | | | | | |
| NOF00-04 | 8/28/00 | YP | 22.1 | 140 | 2000052 (L2000345-2 metals) | <0.02 | <0.20 | 0.49 | <0.04 | 0.21 | 0.11 | ND | ND |
| NOF00-05 | 8/28/00 | YP | 23.8 | 170 | (L2000352-2 organics) | | | | | | | | |
| NOF00-06 | 8/28/00 | YP | 24.2 | 190 | | | | | | | | | |
| NOF00-07 | 8/28/00 | B | 19.1 | 150 | 2000053 (L2000345-3 metals) | <0.02 | <0.20 | 0.50 | <0.04 | 0.17 | 0.53 | ND | ND |
| NOF00-08 | 8/28/00 | B | 20.4 | 190 | (L2000352-3 organics) | | | | | | | | |
| NOF00-09 | 8/28/00 | B | 22.3 | 250 | | | | | | | | | |
| NOF00-10 | 8/28/00 | BC | 21.6 | 150 | 2000054 (L2000345-4 metals) | <0.04 | <0.40 | 0.64 | <0.04 | 0.21 | 0.062 | ND | ND |
| NOF00-11 | 8/28/00 | BC | 22.9 | 180 | (L2000352-4 organics) | | | | | | | | |
| NOF00-12 | 8/28/00 | BC | 25.4 | 210 | | | | | | | | | |
| 1 Species | (YP) yellow perch <i>Perca flavescens</i> | | | | (LMB) largemouth bass <i>Micropterus salmoides</i> | | | | | | | | |
| | (BC) black crappie <i>Pomoxis nigromaculatus</i> | | | | (B) bluegill <i>Lepomis macrochirus</i> | | | | | | | | |

ND - not detected or the analytical result is at or below the established method detection limit (MDL).

Table B1 (Continued). 2000 DEP DWM Buzzards Bay Watershed Fish Toxics Monitoring Data excerpted from 2000 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys (Maietta and Colonna-Romano 2000). Results, reported in wet weight, are from individual fish filets with skin off.

| Sample ID | Collection Date | Species Code ¹ | Length (cm) | Weight (g) | Sample ID (laboratory sample #) | Cd (mg/kg) | Pb (mg/kg) | Hg (mg/kg) | As (mg/kg) | Se (mg/kg) | % Lipids (%) | PCB Aroclors and Congeners (µg/g) | Pesticides (µg/g) |
|--|-----------------|---------------------------|-------------|------------|---------------------------------|------------|------------|------------|------------|------------|--------------|-----------------------------------|-------------------|
| White Island Pond, Plymouth, Buzzards Bay Watershed | | | | | | | | | | | | | |
| WIF00-01 | 8/21/00 | LMB | 33.5 | 680 | 2000071 (L2000347-1 metals) | <0.02 | <0.20 | 0.41 | <0.04 | 0.18 | 0.19 | ND | ND |
| WIF00-02 | 8/21/00 | LMB | 33.3 | 620 | (L2000354-1 organics) | | | | | | | | |
| WIF00-03 | 8/21/00 | LMB | 32.6 | 610 | 2000072 (L2000347-2 metals) | <0.02 | <0.20 | 0.29 | <0.04 | 0.19 | 0.32 | ND | ND |
| WIF00-04 | 8/21/00 | SMB | 34.4 | 600 | (L2000354-2 organics) | | | | | | | | |
| WIF00-05 | 8/21/00 | SMB | 30.9 | 400 | 2000073 (L2000347-3 metals) | <0.02 | <0.20 | 0.14 | <0.04 | 0.09 | 0.25 | ND | ND |
| WIF00-06 | 8/21/00 | SMB | 30.1 | 380 | (L2000354-3 organics) | | | | | | | | |
| WIF00-07 | 8/21/00 | BB | 33.1 | 450 | 2000074 (L2000347-4 metals) | <0.02 | <0.20 | 0.38 | <0.04 | 0.24 | 0.14 | ND | ND |
| WIF00-08 | 8/21/00 | BB | 29.0 | 370 | (L2000354-4 organics) | | | | | | | | |
| WIF00-09 | 8/21/00 | BB | 33.9 | 500 | 2000075 (L2000347-5 metals) | <0.02 | <0.20 | 0.37 | <0.04 | 0.28 | 0.81 | BZ#77-0.0021 | ND |
| WIF00-10 | 8/21/00 | YP | 28.2 | 270 | (L2000354-5 organics) | | | | | | | | |
| WIF00-11 | 8/21/00 | YP | 29.2 | 290 | 2000076 (L2000347-6 metals) | <0.02 | <0.20 | 0.36 | <0.04 | 0.14 | 0.18 | ND | ND |
| WIF00-12 | 8/21/00 | YP | 26.9 | 270 | (L2000354-6 organics) | | | | | | | | |
| WIF00-13 | 8/21/00 | WP | 32.2 | 490 | | | | | | | | | |
| WIF00-14 | 8/21/00 | WP | 31.7 | 490 | | | | | | | | | |
| WIF00-15 | 8/21/00 | WP | 31.0 | 460 | | | | | | | | | |
| WIF00-16 | 8/21/00 | P | 22.3 | 250 | | | | | | | | | |
| WIF00-17 | 8/21/00 | P | 21.4 | 240 | | | | | | | | | |
| WIF00-18 | 8/21/00 | P | 21.5 | 240 | | | | | | | | | |

¹ Species (YP) yellow perch *Perca flavescens*
 (BB) brown bullhead *Ameiurus nebulosus*
 (WP) white perch *Morone Americana*
 (LMB) largemouth bass *Micropterus salmoides*
 (SMB) smallmouth bass *Micropterus dolomieu*
 (P) Pumpkinseed *Lepomis gibbosus*

ND - not detected or the analytical result is at or below the established method detection limit (MDL).

TABLE B2. Analytical Results for 1995 Buzzards Bay Watershed Fish Toxics Monitoring Year 2 Watershed Surveys. Results, reported in wet weight, are from individual or composite samples of fish fillets with skin off.

| Sample ID | Collection Date | Species Code ¹ | Sample Type ² | Length (cm) | Weight (g) | Cd (mg/kg) | Pb (mg/kg) | Hg (mg/kg) | As (mg/kg) | Se (mg/kg) | % Lipids (%) | PCB Arochlors and Cogeners ² (µg/g) | Pesticides (µg/g) |
|-----------------------------------|-----------------|---------------------------|--------------------------|-------------|------------|------------|------------|------------|------------|------------|--------------|--|-------------------|
| Glen Charlie Pond, Wareham | | | | | | | | | | | | | |
| GCF95-1 | 10/5/95 | LMB | C | 32.5 | 440 | <0.20 | <1.00 | 0.381 | <0.040 | 0.096 | 0.020 | ND ³ | ND |
| GCF95-2 | 10/5/95 | LMB | C | 31.9 | 350 | | | | | | | | |
| GCF95-3 | 10/5/95 | LMB | C | 34.1 | 540 | | | | | | | | |
| GCF95-4 | 10/5/95 | YP | C | 22.2 | 80 | <0.20 | <1.00 | 0.259 | <0.040 | 0.083 | 0.040 | ND | ND |
| GCF95-5 | 10/5/95 | YP | C | 23.0 | 90 | | | | | | | | |
| GCF95-6 | 10/5/95 | YP | C | 20.7 | 70 | | | | | | | | |
| GCF95-7 | 10/5/95 | AE | C | 56.2 | 270 | <0.20 | <1.00 | 0.375 | <0.040 | 0.077 | 7.5 | ND | ND |
| GCF95-8 | 10/5/95 | AE | C | 50.0 | 220 | | | | | | | | |
| GCF95-9 | 10/5/95 | AE | C | 40.1 | 170 | | | | | | | | |
| GCF95-10 | 10/5/95 | B | C | 20.2 | 160 | <0.20 | <1.00 | 0.252 | <0.040 | 0.069 | 0.14 | ND | ND |
| GCF95-11 | 10/5/95 | B | C | 19.3 | 140 | | | | | | | | |
| GCF95-12 | 10/5/95 | B | C | 18.7 | 120 | | | | | | | | |
| GCF95-13 | 10/5/95 | WP | I | 29.9 | 320 | <0.20 | <1.00 | 0.740 | 0.047 | 0.112 | 0.10 | ND | ND |

Notes: ¹ Species

American eel (AE) *Anguilla rostrata*
bluegill (B) *Lepomis macrochirus*
brown bullhead (BB) *Ameiurus nebulosus*
black crappie (BC) *Pomoxis nigromaculatus*
chain pickerel (CP) *Esox niger*
largemouth bass (LMB) *Micropterus salmoides*
pumpkinseed (P) *Lepomis gibbosus*
white perch (WP) *Morone americana*
yellow perch (YP) *Perca flavescens*

² Sample Type (All samples were fillets with skin off.)

Composite (C)

Individual (I)

³ ND = Not Detected

* Submitted for organics analysis only.

** Submitted for metals analysis only.

TABLE B2 (Continued). Analytical Results for 1995 Buzzards Bay Watershed Fish Toxics Monitoring Year 2 Watershed Surveys. Results, reported in wet weight, are from individual or composite samples of fish fillets with skin off.

| Sample ID | Collection Date | Species Code ¹ | Sample Type ² | Length (cm) | Weight (g) | Cd (mg/kg) | Pb (mg/kg) | Hg (mg/kg) | As (mg/kg) | Se (mg/kg) | % Lipids (%) | PCB Aroclors and Cogeners ² (ug/g) | Pesticides (ug/g) |
|----------------------------------|-----------------|---------------------------|--------------------------|-------------|------------|------------|------------|------------|------------|------------|--------------|---|-------------------|
| Snipatuit Pond, Rochester | | | | | | <0.20 | <1.00 | 0.552 | <0.040 | 0.390 | 0.22 | ND | ND |
| SPF95-1 | 9/14/95 | LMB | C | 38.6 | 920 | | | | | | | | |
| SPF95-2 | 9/14/95 | LMB | C | 38.4 | 860 | | | | | | | | |
| SPF95-3 | 9/14/95 | LMB | C | 38.6 | 900 | | | | | | | | |
| SPF95-4 | 9/14/95 | P | C | 20.0 | 160 | | | | | | | | |
| SPF95-5 | 9/14/95 | P | C | 17.9 | 120 | | | | | | | | |
| SPF95-6 | 9/14/95 | B | C | 20.3 | 190 | | | | | | | | |
| SPF95-7 | 9/14/95 | BC | C | 30.5 | 390 | | | | | | | | |
| SPF95-8 | 9/14/95 | BC | C | 28.5 | 370 | | | | | | | | |
| SPF95-9 | 9/14/95 | BC | C | 27.4 | 320 | | | | | | | | |
| SPF95-10 | 9/14/95 | AE | C | 62.1 | 340 | | | | | | | | |
| SPF95-11 | 9/14/95 | AE | C | 59.9 | 400 | | | | | | | | |
| SPF95-12 | 9/14/95 | AE | C | 52.3 | 250 | | | | | | | | |
| SPF95-13 | 9/14/95 | YP | C | 21.4 | 100 | | | | | | | | |
| SPF95-14 | 9/14/95 | YP | C | 20.8 | 100 | | | | | | | | |
| SPF95-15 | 9/14/95 | YP | C | 19.3 | 80 | | | | | | | | |
| SPF95-16 | 9/14/95 | BB | I | 24.9 | 180 | | | | | | | | |
| SPF95-17 | 9/14/95 | CP | I | 39.1 | 350 | | | | | | | | |

Notes: ¹ Species
² Sample Type (All samples were fillets with skin off.)
Composite (C)
Individual (I)

American eel (AE) *Anguilla rostrata*
bluegill (B) *Lepomis macrochirus*
brown bullhead (BB) *Ameiurus nebulosus*
black crappie (BC) *Pomoxis nigromaculatus*
chain pickerel (CP) *Esox niger*
largemouth bass (LMB) *Micropterus salmoides*
pumpkinseed (P) *Lepomis gibbosus*
white perch (WP) *Morone americana*
yellow perch (YP) *Perca flavescens*

³ ND = Not Detected
* Submitted for organics analysis only.
** Submitted for metals analysis only.

APPENDIX C

Memorandum

To: Dave Pincumbe, US EPA, Region 1, New England, Boston, MA

Through: Arthur Johnson, MA DEP/DWM, Worcester, MA

From: John Fiorentino, MA DEP/DWM, Worcester, MA

Date: 21 August 2000

Subject: **Qualitative benthos assessment upstream and downstream of Marion WWTP**

Upon request by US EPA, the Massachusetts Department of Environmental Protection's Division of Watershed Management (MA DEP/DWM) conducted biological monitoring upstream and downstream from the Marion WWTP (NPDES Permit No. MA0100030) facility's discharge to its unnamed receiving stream known locally as Effluent Brook. Sampling was conducted 17 May 2000 by John Fiorentino of DWM, with assistance from Dave Pincumbe of EPA.

Aquatic benthic macroinvertebrate biomonitoring was conducted based on modifications to US EPA Rapid Bioassessment Protocol I (RBP I), a screening or reconnaissance assessment that documents specific visual observations made in the field by a trained professional. RBP I is used to discriminate obviously impacted and non-impacted areas from potentially affected areas. A biosurvey component focuses on qualitative sampling of benthic macroinvertebrates, and is supplemented by a preliminary field examination of other aquatic biota (periphyton, macrophytes, and fish). Qualitative benthic samples are collected from all available habitats using a "kick" net; Benthic macroinvertebrate orders/families are observed in the field (or in this case, in the laboratory) and listed on a field data sheet with an estimate of their relative abundance. On the basis of the observations made on habitat, water quality data (when available), physical characteristics, and the qualitative biosurvey, the investigator determines whether impairment is detected. Impairment may be indicated by the absence of generally pollution-sensitive benthic macroinvertebrate taxa such as Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)—collectively known as EPTs; dominance of generally pollution-tolerant groups such as Oligochaeta or Chironomidae; or overall low benthic abundance or taxa richness. If impairment is detected, the study area should be considered for more intensive evaluation such as RBP III, toxicity testing, or quantitative studies based on statistical hypothesis testing.

To determine the effects of the Marion WWTP discharge on the aquatic community of Effluent Brook, DWM conducted sampling at one station immediately upstream from the discharge, and two downstream stations approximately 100 m and 0.5 miles downstream from the discharge respectively. Instream benthos habitat was relatively similar at all stations with respect to epifaunal substrate composition—sand and fine sediments dominated, with occasional cobble and gravel present as well. In addition, snags and aquatic vegetation—most notably *Callitriche* sp.—provided additional benthic microhabitat at all stations. Beds of *Callitriche* sp. were particularly dense downstream from the discharge. Filamentous green algae was observed at all sampling stations, but appeared most abundant downstream from the discharge. Productive lotic habitat was extremely limited upstream from the discharge, with low base flow resulting in poorly developed riffle areas and exposed benthos habitat. Immediately downstream from the discharge flow regimes improved considerably as the stream received significant discharge contributions (approximately 50%) from the treated effluent. Despite the sandy nature of much of the stream reach downstream from the discharge, riffle areas and occasional larger substrates provided

good macroinvertebrate habitat. Riparian habitat—consisting of mostly forested undeveloped space—remains relatively undisturbed throughout most of the Effluent Brook subwatershed; however, nonpoint source pollution inputs associated with the new home construction that has recently commenced here may threaten this stream in the near future.

Despite the limited benthos habitat resulting from naturally-occurring (i.e., intermittent) low base flow upstream from the discharge, a surprisingly diverse macroinvertebrate assemblage was observed. Fifteen taxa, representing virtually every benthic macroinvertebrate trophic guild, were collected in the 100 m reach above the effluent discharge (Table 1). In addition, four of these taxa were pollution-sensitive EPTs, including two families (Leuctidae and Nemouridae) of Plecoptera—generally considered the most intolerant of the insect orders.

Community composition and trophic structure changes abruptly at the Marion WWTP discharge point. Most trophic groups are displaced by more opportunistic gathering collectors, indicating that deposited organic matter is the predominant food resource immediately downstream from the discharge. Suboptimal community structure—and especially the hyperdominance of red chironomids and naidid worms—is indicative of an aquatic community structured in response to organic enrichment and possibly low levels of dissolved oxygen. The displacement of EPT and other sensitive taxa by organisms considered more tolerant of organic pollution is typical of a benthos assemblage located downstream from a point source discharge.

Slight improvements in community composition and trophic structure were detected at the most downstream sampling location. The return of additional trophic guilds and the addition of several macroinvertebrate taxa—including two EPT taxa, suggest some recovery to the aquatic community in this portion of Effluent Brook.

It is unknown what effect the increase in effluent discharge proposed by the Marion WWTP may have on the Effluent Brook aquatic community; however, current benthos data suggest that improved levels of effluent treatment may be warranted. While future impacts to the macroinvertebrate assemblage immediately downstream from the discharge may be indiscernible, it is possible that discharge effects—especially in lieu of adequate effluent treatment—may be more pronounced further downstream in the form of a suppressed or altogether absent “recovery zone”. If in fact, increased discharge and effluent treatment upgrades do occur, it is highly recommended that biomonitoring be conducted here again after these changes have gone into effect. More intensive upstream-downstream comparisons of the resident biota—based on statistical hypothesis testing—should be considered for future biomonitoring efforts.

Cc: Bryant Firmin
Ron Lyberger

Table 1. List of macroinvertebrates collected (qualitatively) from 3 stream sites in Effluent Brook on 17 May 2000. Taxon presence at a station is indicated with an "x".

| TAXON | FFG ¹ | TV ² | upstream from WWTP | 100 m downstrea m from WWTP | 0.50 miles downstrea m from WWTP |
|--------------------|------------------|-----------------|--------------------------|---|--|
| Planorbidae | SC | 6 | x | | |
| Physidae | GC | 8 | x | x | x |
| Pisidiidae | FC | 8 | x | x | x |
| Lumbriculidae | GC | 8 | x | x | x |
| Naididae | GC | 9 | x | x | x |
| Glossophoniidae | PR | 7 | | | x |
| Asellidae | GC | 8 | x | x | x |
| Crangonyctidae | GC | 8 | x | | |
| Hydracarina | PR | 6 | x | | |
| Leuctridae | SH | 0 | x | | |
| Nemouridae | SH | 2 | x | | |
| Hydropsychidae | FC | 4 | | | x |
| Limnephilidae | SH | 4 | x | | x |
| Hydrophilidae | PR | 5 | x | x | |
| Simuliidae | FC | 6 | x | | x |
| Tipulidae | SH | 5 | x | | x |
| Chironomidae | GC | 6 | x | x | x |
| Chironomidae (red) | GC | 8 | | x | |

¹ Functional Feeding Group (FFG) lists the primary feeding habit of each species and follows the abbreviations: SH-Shredder; GC-Gathering Collector; FC-Filtering Collector; SC-Scraper; PR-Predator.

² Tolerance values (TV) range from 0 for organisms very intolerant of organic pollution to 10 for organisms very tolerant.

APPENDIX D – DEP GRANT AND LOAN PROGRAMS

Excerpted from the DEP/DWM World Wide Web sites,
<http://www.state.ma.us/dep/brp/mf/othergrt.htm>
<http://www.state.ma.us/dep/brp/wm/projsums.htm>

604(B) WATER QUALITY MANAGEMENT PLANNING GRANT PROGRAM

This grant program is authorized under the federal Clean Water Act Section 604(b) for water quality assessment and management planning. There have been no 604(b) grants awarded in the Buzzards Bay Watershed.

104(B) (3) WETLANDS AND WATER QUALITY GRANT PROGRAM

This grant program is authorized under the wetlands and Clean Water Act Section 104(b)(3) of the federal Clean Water Act. The water quality proposals received by DEP under this National Environmental Performance Partnership Agreement (NEPPA) with the U.S. Environmental Protection Agency is a results oriented approach that will focus attention on environmental protection goals and the efforts to achieve them. The goals of the NEPPA are to: 1) achieve clean air, 2) achieve clean water, 3) protect wetlands, 4) reduce waste generation, and 5) cleanup waste sites.

- 97-09/104 *Project on Numeric Biocriteria*. This proposal is designed to address two issues relating to the current Biocriteria Pilot Study; specifically, to evaluate subecoregion difference in stream biota, if any, and formulate the biological indicators (fish and macroinvertebrates) that are essential to assess conditions and monitor changes in streams. Study expects to establish reference streams in 5 of the 13 Massachusetts Ecological Subregions.

Numeric Biocriteria sampling in the Buzzards Bay Watershed. MA DEP DWM. 2000. Open files. *Biocriteria Development Project files*. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

| Stream | Station | Sampling Dates |
|------------------------|---------|----------------|
| Unnamed Tributary | NB03COP | October 1996 |
| Mattapoissett River | NB13MAT | October 1996 |
| Bread and Cheese Brook | NB04BAC | October 1996 |
| Shingle Island River | NB14SHI | October 1996 |

- 99-06/104 *Lake Surveys for TMDL Development*. The objective for this statewide study is to provide a database for lakes listed as impaired on the 303d list. Data such as Secchi, bathymetry, nutrients, aquatic plant species composition and plant coverage will be compiled to determine optimal plant coverage for fisheries. Additionally, the Division will provide technical assistance and transfer of fisheries data to government agencies and private organizations involved in watershed management and assist in the development of volunteer and watershed participant action plans. Two lakes in the Buzzards Bay Watershed, Federal Pond in Carver and Parker Mills Pond in Wareham, were sampled as part of this project in 2000.
- 02-01c/104 *Acushnet River TMDL Surface Water Flow and Nitrogen Load: Nitrogen Loading to New Bedford Inner Harbor* This project will quantify Acushnet River discharge and nitrogen loading from the upper watershed region to New Bedford Inner Harbor and support the development of water quality models and nitrogen loading thresholds for this system. In addition, analysis will be made to determine the potential for the river to be a source of bacterial (fecal coliform, *E. coli*, *Enterococci*) contamination to the estuary. A stream gauge will be maintained and nitrogen and bacterial samples collected weekly for 12 months, with additional samples associated with rain events. The goal of the project is to help acquire sufficient data that can later be used by DEP and EPA in the development of appropriate TMDL and management approaches for the restoration of

water quality in the Acushnet River Estuary system. Also, the data collected are directly applicable to on-going nitrogen issues relating to management and permitting of NPDES discharges within this system. The project will leverage other proposed and on-going efforts for this system (EMPACT, CZM, EPA) and is an important component for application of the Massachusetts Estuaries Project approach to the Acushnet River Estuary.

- 03-02/104c *Quantifying The Build-Up Of Solids And Contaminants On Street Surfaces, And Their Potential Removal By Street-Sweeping Technologies, New Bedford, Massachusetts* Storm water runoff from impervious surfaces has been identified as a significant source of contaminant loading to urban waterways. the City of New Bedford, Massachusetts removed an average of 4,100 cubic yards of sediment annually from 440 miles of street surface in the 1990 to 1995 period, using both mechanical and vacuum sweepers. This street-sweeping effort realized a greater than 92-percent reduction of sediment entering New Bedford's wastewater treatment plant from the combined-sewer areas of the City. The study objectives are to (1) provide preliminary estimates of contaminant build-up rates on selected street surfaces during dry weather periods in an urban New England setting; (2) compare sediment removal efficiencies of mechanical and vacuum sweepers for a range of grain-size classes; (3) characterize the chemical quality of the sediments presently being removed by vacuum sweepers in New Bedford, and the annual loads of selected contaminants that the City presently removes from its streets.

319 NONPOINT SOURCE GRANT PROGRAM

This grant program is authorized under Section 319 of the CWA for implementation projects that address the prevention, control, and abatement of nonpoint source (NPS) pollution. In order to be considered eligible for funding projects must: implement measures that address the prevention, control, and abatement of NPS pollution; target the major source(s) of nonpoint source pollution within a watershed/subwatershed; have a 40 percent non-federal match of the total project cost (match funds must meet the same eligibility criteria as the federal funds); contain an appropriate method for evaluating the project results; address activities that are identified in the Massachusetts NPS Management Program Plan. 319 projects in the Buzzards Bay Watershed include:

- 99-01/319 *Alternative Septic System Test Center Project Monitoring*. For 12 months, this project will concurrently monitor contaminant removal by twenty-one wastewater systems at the Alternative Septic System Test Center at the Massachusetts Military Reservation. The monitoring will produce a scientifically valid body of data which will be disseminated to state regulators, local boards of health, installers, and consumers through trade shows, newspaper articles, site visits, and through Website coverage. Project goals are to: provide verified, comparable data for regulatory decision making; speed approval of technologies which have advanced contaminant removal, particularly nitrogen; and increase the variety of alternative systems approved to provide greater sitting flexibility and thus reduce the cost to consumers and benefit the environment.
- 99-04/319 *Winsegansett Salt Marsh Restoration Project*. Winsegansett Salt Marsh is a 30-acre coastal wetland on the western shore of Buzzards Bay. This project will replace a culvert beneath Winsegansett Avenue with a larger box culvert thereby restoring natural tidal flow, increasing salinity in the marsh and eliminating an existing stand of *Phragmites*. The end objective is to permit natural recolonization of *Spartina* plant communities in the upper reaches of Winsegansett Marsh, thereby improving juvenile finfish and shellfish habitat and supporting the feeding habitats of local wildlife species, including the federally-listed endangered Roseate Tern and Osprey. The project also includes publication and distribution of the "Atlas of Tidally Restricted Salt Marshes in Buzzards Bay" which can be used to target other salt marshes in need of similar restoration efforts. Tasks to be completed under this project include: design and installation of the box culvert at Winsegansett Avenue; monitoring of pre- and post-construction water quality in accordance

with an EPA-approved sampling protocol, and pre- and post-construction GIS mapping of the extent of salt marsh vegetation in Winsegansett Salt Marsh; and printing and distribution of the "Atlas of Tidally Restricted Salt Marshes" to coastal communities in Buzzards Bay.

- 00-02/319 *Alternative Septic System Test Center Project Monitoring II* This project will continue the monitoring of contaminant removal by twenty-one wastewater systems at the Alternative Septic System Test Center at the Massachusetts Military Reservation, first undertaken in project 99-01/319. The monitoring will produce a scientifically valid body of data which will be disseminated to state regulators, local boards of health, installers and consumers through trade shows, newspaper articles, site visits, and through Website coverage. Project goals continue to be to: provide verified, comparable data for regulatory decision making; speed approval of technologies which have advanced contaminant removal, particularly nitrogen; increase the variety of alternative systems approved to provide greater siting flexibility and thus reduce the cost to consumers and benefit the environment; and provide needed baseline data about the conventional system's contaminant removal capabilities.
- 00-03/319 *Development of a Rapid Field Test for the Quality of Stone Aggregate in Onsite Septic Systems* This project will develop and/or validate a simple field test for quality of stone aggregate used in the soil absorption portions of onsite septic systems. The overall goal is to encourage the production of better quality aggregate. Project goals are: to promote the use of aggregate that will maximize the life of soil absorption systems and meet the intent of Title 5 to prevent the intrusion of fine-textured material at the system-soil interface; to determine the validity of the various simple field tests (i.e., the bucket test) in predicting the level of fine-textured material in aggregate samples; to correlate the findings of simple field tests with the actual level of impairment to the leaching facility imparted by the level of fines observed; to refine the test for aggregate such that the result will indicate an appropriate level of "clean" that is neither too restrictive/cost prohibitive, nor too lenient as to decrease the life of a leaching facility; to produce a guidance document that will describe the appropriate methodology for testing aggregate in the field and to provide training workshops for its use.
- 00-05/319 *Atlas of Stormwater Discharges* This project will prepare, print and disseminate a "user friendly" *Atlas of Stormwater Discharges* for the Buzzards Bay. The *Atlas* will then be used for an outreach program designed to assist Buzzards Bay communities in preparing grant application to the DEP 319 and MCZM CPR grant programs to mitigate storm water discharges into the Bay. The project is an important first step in implementing the Buzzards Bay Comprehensive Conservation and Management Plan (CCMP), one of the first comprehensive watershed management plans to be completed in the Commonwealth. One of the priority management issues identified in the CCMP is control and remediation of storm water discharges impacting the water quality of Buzzards Bay. Investigations by the Buzzards Bay Project and Division of Marine Fisheries have identified storm water runoff as the primary factor in most of the Bay's shellfish bed closures. Today, more than 10,000 acres of shellfish beds in Buzzards Bay are closed to harvest due to elevated levels of fecal coliform bacteria with a subsequent loss of economic opportunity to coastal communities. Due to the unique nature of the Buzzards Bay coastline, restoration of Bay water quality is highly dependent on localized remediation of storm water runoff.
- 00-09/319 *Onset Bay, Wareham, MA, Nonpoint Source Pollution Remediation Project* The northern portion of Onset Bay is closed to shellfishing from May 1st through November 1st, due in large part to fecal contamination associated with storm water runoff. The 1989 report entitled *Sanitary Survey Report of Onset Bay in the Towns of Bourne and Wareham* identified fecal contamination as the principal contributing factor in shellfish area closures in the area. The Town of Wareham has made substantial

investment to sewer the Onset and Point Independence areas and so has virtually eliminated failing or substandard septic systems as a source of fecal contamination to the Bay. The Town has also undertaken a comprehensive storm water management program and has made significant progress in remediating storm water discharges at several problem areas in town. This project will address four storm water outfalls that discharge directly into Onset Bay from South Boulevard and the Onset Town Pier. The project augments previous projects undertaken by the Town of Wareham to remediate storm water impacts to local shellfish beds. The goals of the project are to upgrade the seasonally closed shellfishing areas of Onset Bay and to mitigate the direct storm water discharges located at public beaches along South Boulevard. Remediation efforts at the four storm water discharges will concentrate on subsurface infiltration of the “first flush” or the first one-half inch of runoff from a precipitation event. Soil conditions at the sites are mapped as Carver coarse sands with water tables expected to be in excess of six to ten feet below grade. These soils are excellent for storm water infiltration and will provide a high degree of treatment. Critical catch basin structures will also be upgraded to provide deep sumps, hoods and pipes to infiltration chambers.

- 01-05/319 *Evaluation of Phosphorus Removal in Onsite Septic Systems* This research project will support implementation of Total Maximum Daily Loads (TMDL) of phosphorus to freshwater bodies that currently do not meet water quality standards. All information that can be used to reduce phosphorus inputs will be vital in implementing lake TMDLs in coming years. It will also further the goals of the Department’s Title 5 Program that approves alternative onsite septic systems and alternatives to onsite septic systems where appropriate. The project will test a minimum of four different onsite septic technologies that purport to remove phosphorus, and test the efficacy of installing phosphorus-removing reactive media beneath standard septic systems. The project also includes a report on the feasibility of scaling up the tested technologies to serve small clustered areas of development and the potential for using small packaged treatment plants for removing phosphorus from wastewater. The goal is to develop proven options for reducing phosphorus inputs to fresh water bodies from onsite septic systems. Testing will be done at the Massachusetts Alternative Septic System Test Center.
- 01-07/319 *Wareham NPS Remediation Program: East River, Broad Cove, Muddy Cove* The northern portion of Onset Bay is closed to shellfishing from May 1st through November 1st, due in large part to fecal contamination associated with storm water runoff. The Town of Wareham has made substantial investment to sewer the Onset and Point Independence areas and so has virtually eliminated failing or substandard septic systems as a source of fecal contamination to the Bay. The Town has also undertaken a comprehensive storm water management program and has made significant progress in remediating storm water discharges at several problem areas in town. This project will install storm water BMPs (i.e.; deep sump catch basins, infiltration chambers and possibly Stormtreat systems) at seven storm water outlets in Onset village. The BMPs will be installed on town land in the road right-of-way at one site at the East Avenue boat ramp, four sites along North Boulevard, one site at the Stone Bridge Marina and one site off of East Boulevard. The project augments previous projects undertaken by the Town of Wareham to remediate storm water impacts to local shellfish beds. The work done in this project will be upstream of work done as part of another 319-funded project (00-09/319) which addressed four storm water outfalls that discharge directly into Onset Bay, and a similar project funded through the CZM CPR Program. The goals of the project are to upgrade the seasonally closed shellfishing areas of Onset Bay, protect swimming beaches along Onset Bay and begin remediation of estuarine resources in the Bay by reducing fecal coliform entering Onset Bay.
- 01-12/319 *Cranberry Bog Phosphorus Dynamics for TMDL Development* (University of Massachusetts Cranberry Experiment Station). This project will study phosphorus dynamics in Massachusetts cranberry bogs to assist the MA DEP in formulating Total

Maximum Daily Load performance standards. Specifically, the objectives of this project are (1) determine phosphorus and nitrogen import and export from representative cranberry beds associated with water management, including floods, irrigation, and rain events; (2) determine nitrogen and phosphorus export from a natural freshwater wetland; (3) determine phosphorus and nitrogen export from beds where phosphorus fertilizer rates are reduced to less than 20 pounds of phosphorus per acre; and (4) determined the impact of reduction in phosphorus fertilization on cranberry sustainability.

- 02-06/319 *Head of Westport Stormwater Project* In the Town of Westport, the Westport River has 35 miles of shoreline and drains approximately 85% of the town's land area. The river supports an extensive and productive estuarine habitat including over 1000 acres of salt marsh vegetation. Within the estuary, there are approximately 3000 acres of shellfish beds. Two branches of the River, the East Branch and the West Branch, converge at Westport Point to form a single discharge into Buzzards Bay. The tidal component of the East Branch extends from the area known as the Head of Westport to the mouth of the river. The watershed of the East Branch is the larger of the two branches and consists primarily of agricultural and residential land use in the lower region, and forest in the upper part. Currently, the East Branch of the Westport River from Lake Noquochoke to the West branch is 303d listed for pathogens. This bacterial contamination threatens the health of the shellfish beds located within the watershed, causing restrictions on harvesting. The goal of the project is to improve water quality in the East Branch by reducing nonpoint source pollution at the Head of Westport through implementation of a combination of structural storm water control Best Management Practices to remove bacteria from the first flush of storm water, and public outreach and education to watershed stakeholders.

MASSACHUSETTS WATERSHED INITIATIVE PROJECTS

The Massachusetts Watershed Initiative is a broad partnership of state and federal agencies, conservation organizations, businesses, municipal officials and individuals that protects and restores natural resources and ecosystems on a watershed basis. The primary goals of the Watershed Initiative are to: improve water quality; restore natural flows to rivers; protect and restore habitats; improve public access and balanced resource use; improve local capacity to protect water resources; and, promote shared responsibility for watershed protection and management. Projects funded under the MWI include hydrologic and water quality monitoring and assessment, habitat assessment, nonpoint source assessment, hydrologic modeling, open space and growth planning, technical assistance and outreach. MWI projects in the Buzzards Bay Watershed include:

- 99-03/MWI *Nutrients, Eutrophication and Harmful Algal Blooms in Buzzards Bay, Massachusetts*. The purpose of this project is to further analyze water quality and biological samples collected since 1987 in Buzzards Bay. This will be accomplished by completing taxonomic analyses of selected phytoplankton samples and completing analyses and consolidation of nutrient and other data collected.
- 01-02/MWI *Westport River Nonpoint Source Pollution Assessment Project*. This project will conduct an assessment of nonpoint source pollution in the Westport River subwatershed of Buzzards Bay.
- 02-03/MWI *Slocums and Little River Flushing Studies*. This project will conduct detailed flushing and particle tracking studies of the Slocums River and Little River Systems for use in developing TMDLs.

SOURCE WATER AND TECHNICAL ASSISTANCE/LAND MANAGEMENT GRANT PROGRAM

The Source Water Protection Technical Assistance/Land Management Grant Program provides funds to *third party* technical assistance organizations that assist public water suppliers in protecting local and regional ground and surface drinking water supplies.

- 99-14/SWT *Resource Planning for Cranberry Bogs within Drinking Water Supply Areas*. This project will provide direct technical assistance with farm planning to cranberry growers in the Cape Cod, Buzzards Bay, Taunton, South Coastal, and Nantucket Basins in an effort to conserve and protect water resources. Resource planning for cranberry bogs located within or adjacent to public drinking water supply areas will provide cranberry growers with the information necessary for the protection of public surface and groundwater drinking water supplies in Southeastern Massachusetts.

MASSACHUSETTS DRINKING WATER STATE REVOLVING FUND PROGRAM

The Massachusetts Drinking Water State Revolving Fund (DWSRF) provides low-cost financing to help community public water suppliers comply with federal and state drinking water requirements. The DWSRF Program's goals are to protect public health and strengthen compliance with drinking water requirements, while addressing the Commonwealth's drinking water needs. The Program incorporates affordability and watershed management priorities. The DWSRF Program is jointly administered by the Division of Municipal Services of the Department of Environmental Protection (MA DEP) and the Massachusetts Water Pollution Abatement Trust (Trust). The current subsidy level is equivalent to a 50% grant, which approximates a two percent interest loan. The Program will initially operate with approximately \$50 million in financing capacity. For calendar years 1999 through 2003, up to \$400 million may be available through the loan program.

- *Water Main Rehabilitation (SRF ID 1707)*. New Bedford
- *Lining on Vinyl Lined AC Water Main (SRF ID 1656)*. Dartmouth
- *Cement Line Water Main (SRF ID 1655)*. Dartmouth

WELLHEAD PROTECTION GRANT PROGRAM

The Wellhead Protection Grant Program provides funds to assist public water suppliers in addressing wellhead protection through local projects and education.

- 99-24/WHP *Wareham Wellhead Protection Project* This project will install 6 monitoring wells for potential contamination from pesticides, fertilizers, and priority pollutant metals associated with cranberry bog activities.
- 01-10/WHP *Old Colony Vocational School Replacement Fuel/Waste Storage Tank*. This project will replace two above-ground fuel/waste storage tanks located in the well's recharge area with tanks that have secondary containment and appropriate safe guards.

RESEARCH AND DEMONSTRATION GRANT PROGRAM

The Research and Demonstration Program (R&D) is authorized by section 38 of Chapter 21 of the Massachusetts General Laws and is funded by proceeds from the sale of Massachusetts bonds. Specifically, the R&D Program was established to enable the Department to conduct a program of study and research and demonstration relating to water pollution control and other scientific and engineering studies "...so as to insure cleaner waters in the coastal waters, rivers, streams, lakes and ponds of the Commonwealth." R&D projects in the Cape Cod Watershed include:

- 02-06/R&D *Coastal Embayment Delineations* For this project the United States Geological Survey will develop a regional understanding of the ground-water flow and the sources of water to ecologically sensitive coastal embayments throughout Cape Cod. The delineation of the contributing areas, the determination of time-of-travel distributions, and the calculation of groundwater fluxes to the natural receptors will be completed for current pumping and recharge conditions. Ground-water flow models previously developed for the delineation of the source of water to public-supply wells will be used to: delineate areas that contribute water to coastal embayments, upgradient ponds and streams, and wetlands greater than 16 acres in area; determine time-of-travel distributions within the embayment contributing areas; and determine steady-state ground-water fluxes to coastal embayments as well as the ponds and streams within the contributing areas to these.

CLEAN WATER STATE REVOLVING LOAN FUND (CWSRF) PROGRAM

The Massachusetts State Revolving Fund for water pollution abatement projects was established to provide a low-cost funding mechanism to assist municipalities seeking to comply with federal and state water quality requirements. The SRF Program is jointly administered by the Division of Municipal Services of the Department of Environmental Protection and the Massachusetts Water Pollution Abatement Trust. Each year the Department solicits projects from Massachusetts municipalities and wastewater districts to be considered for subsidized loans, which are currently offered at 50% grant equivalency (approximates a no-interest loan). In recent years the program has operated at an annual capacity of \$150 to \$200 million per year, representing the financing of 40 to 50 projects annually. The SRF Program now provides increased emphasis on watershed management priorities. A major goal of the SRF Program is to provide incentives to communities to undertake projects with meaningful water quality and public health benefits and which address the needs of the communities and the watershed.

- *MARION 1725 WWT and Collection System Improvements* Marion's Wastewater Treatment Facility is being upgraded to provide pretreatment (grit and screenings removal) and sequencing batch reactors (SBRs) for ammonia removal. The upgrade will reduce the nitrogen load to Aucoot Cove and Buzzards Bay. The plant construction will begin in August 2003 and the plant should begin startup in spring 2005. In addition, the Town is sewerage three areas of town where existing, dense housing cannot be adequately supported by on-site systems due to high groundwater and poor soils. Sewering these areas will reduce bacteria and nutrient loads to Sippican Harbor and the Weweantic River watershed; and instead the wastewater will be treated to a high quality effluent at the central facility.

Additional 2003 projects:

- *WWTP Upgrade (SRF ID 898)*. Wareham
- *Earle Street Separation (SRF ID 1726)*. New Bedford
- *West End Sewer Separation Phase 2 (SRF ID 1727)*. New Bedford
- *West End Sewer Separation Phase 3 (SRF 1728)*. New Bedford
- *Black Brook Corridor Water Resource Lands (SRF ID 1744)*. New Bedford
- *Sewage Collection System (SRF ID 1732)*. Acushnet
- *Brandt Beach Sewer Extension Project (SRF ID 1711)*. Mattapoisett
- *Construction of UV at WWTP (SRF ID 1716)*. Fairhaven
- *Route 6 Sewer Extension (SRF ID 1708)*. Mattapoisett
- *Weweantic Shores Sewers and PS (SRF ID 1743)*. Wareham
- *Construction of New Odor Control Facilities (SRF ID 1717)*. Fairhaven
- *Construction of new sewers (SRF ID 1715)*. Dartmouth
- *Betty's Neck/ Pond Complex Pres. Program (SRF ID 1745)*. New Bedford

COMMUNITY SEPTIC MANAGEMENT PROGRAM

The enactment of the Open Space Bond Bill in March of 1996 provided new opportunities and stimulated new initiatives to assist homeowners with failing septic systems. The law appropriated \$30 million to the MA DEP to assist homeowners. The Department will use the appropriation to fund loans through the Massachusetts Water Pollution Abatement Trust. The fund will provide a permanent state/local administered revolving fund to assist income-eligible homeowners in financing necessary Title 5 repairs. Working together, the MA DEP and the Trust have created the Community Septic Management Program to help Massachusetts' communities protect threatened ground and surface waters while making it easier to comply with Title 5. This loan program offers three options from which a local governmental unit can choose.

APPENDIX E - DMF SHELLFISH DATA, BUZZARDS BAY WATERSHED

It is the mission of the Division of Marine Fisheries (DMF) to manage, develop, and protect the Commonwealth's renewable living marine resources to provide the greatest public benefit. DMF fosters protection of the marine environment by cooperating with other state and federal agencies on pollution abatement, coastal wetlands protection and other programs concerning coastal waters and marine life. DMF monitors coastal contaminant levels in fish and shellfish, operates a shellfish depuration facility, and evaluates the impacts of coastal development on marine fish and their habitats. DMF provides assistance to local shellfish officers on matters affecting the management of shellfish, and provides expertise on anadromous fish and construction assistance on fishways. Other DMF programs assist commercial and recreational fishermen and educate the public on marine resource issues and values.

The DMF Shellfish Management Program manages shellfish growing areas in compliance with the National Shellfish Sanitation Program (NSSP). The NSSP is a federal/state cooperative program recognized by the U.S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC). One goal of this program is the sanitary control of shellfish harvested and sold for human consumption. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units, and range from being approved to prohibited (six different classification types in all) with respect to shellfish harvest (Tables E1). Shellfish growing area classifications by subwatershed are provided in Tables E3-E6. Designated shellfish growing areas (as of July 2000) may be viewed using the MassGIS datalayer available from MassGIS at <http://www.state.ma.us/mgis/dsga.htm>.

Table E1. DMF Shellfish Management Program Managed Shellfish Growing Area Classifications.

| Classification Type | Definition |
|--------------------------|--|
| Approved | Open for harvest of shellfish for direct human consumption. |
| Conditionally Approved | During the time the area is approved, it is open for harvest of shellfish for direct human consumption subject to local rules and state regulations. |
| Conditionally Restricted | During the time the area is restricted, it is only open for the harvest of shellfish with depuration subject to local rules and state regulations. |
| Restricted | Open for harvest of shellfish with depuration subject to local rules and state regulations for the relay of shellfish. |
| Management Closure | Closed for the harvest of shellfish. Not enough testing has been done in the area to determine whether it is fit for shellfish harvest or not. |
| Prohibited | Closed for the harvest of shellfish. |

Classification area codes and town names identify each DMF shellfish area. The Buzzards Bay Watershed Water Quality Assessment Report describes each shellfishing area by its classification area code and the assessed region is defined in square miles within the DEP/DWM water body system segment. As of July 2000 DMF classified a total of 261,901.3 acres in the Buzzards Bay Watershed (Table E2).

Table E2. Summary Shellfish Classification Area Information as of July 2000.

| Classification Type | Area (acres) |
|----------------------------|---------------------|
| Approved | 232559.5 |
| Conditionally Approved | 13187.88 |
| Management Closure | 230.99 |
| Prohibited | 9722.802 |
| Restricted | 6200.129 |

Table E3. Buzzards Bay Watershed DMF - Shellfish Project Classification Area Information as of July 2000.

| Town | Classification Area Code | Classification Type | Area (Acres) |
|-------------|---------------------------------|----------------------------|---------------------|
| Acushnet | BB15.1 | Prohibited | 51.29 |
| Bourne | BB28.0 | Approved | 73.784 |
| Bourne | BB28.0 | Approved | 885.372 |
| Bourne | BB33.0 | Approved | 0.001 |
| Bourne | BB38.0 | Approved | 62.551 |
| Bourne | BB39.0 | Approved | 3.569 |
| Bourne | BB40.0 | Approved | 82.511 |
| Bourne | BB43.0 | Approved | 116.369 |
| Bourne | BB43.4 | Conditionally Approved | 4.404 |
| Bourne | BB43.5 | Prohibited | 0.461 |
| Bourne | BB43.6 | Prohibited | 1.931 |
| Bourne | BB43.8 | Prohibited | 23.214 |
| Bourne | BB44.0 | Approved | 383.832 |
| Bourne | BB44.2 | Conditionally Approved | 5.855 |
| Bourne | BB44.7 | Prohibited | 12.834 |
| Bourne | BB44.8 | Conditionally Approved | 49.726 |
| Bourne | BB45.1 | Prohibited | 35.838 |
| Bourne | BB45.2 | Approved | 135.7 |
| Bourne | CCB35.0 | Approved | 0.354 |
| Bourne | CCB38.0 | Approved | 2243.641 |
| Bourne | CCB51.0 | Approved | 0 |
| Dartmouth | BB10.0 | Approved | 887.785 |
| Dartmouth | BB10.0 | Approved | 2715.556 |
| Dartmouth | BB10.2 | Prohibited | 314.844 |
| Dartmouth | BB10.2 | Prohibited | 47.675 |
| Dartmouth | BB11.0 | Approved | 1429.585 |
| Dartmouth | BB11.0 | Approved | 4645.364 |
| Dartmouth | BB11.2 | Prohibited | 1.166 |
| Dartmouth | BB11.2 | Prohibited | 82.849 |
| Dartmouth | BB12.1 | Restricted | 55.806 |
| Dartmouth | BB12.2 | Restricted | 2.79 |
| Dartmouth | BB12.20 | Conditionally Approved | 99.63 |
| Dartmouth | BB12.3 | Conditionally Approved | 143.123 |
| Dartmouth | BB12.4 | Prohibited | 66.375 |
| Dartmouth | BB12.5 | Approved | 237.114 |
| Dartmouth | BB12.6 | Approved | 5.886 |
| Dartmouth | BB12.7 | Conditionally Approved | 70.435 |
| Dartmouth | BB13.1 | Conditionally Approved | 219.431 |
| Dartmouth | BB13.20 | Conditionally Approved | 173.709 |
| Dartmouth | BB13.21 | Conditionally Approved | 3.183 |
| Dartmouth | BB13.22 | Conditionally Approved | 18.42 |

| Town | Classification Area Code | Classification Type | Area (Acres) |
|-------------|-------------------------------------|----------------------------|---------------------|
| Dartmouth | BB13.3 | Restricted | 92.975 |
| Dartmouth | BB13.4 | Restricted | 1.468 |
| Dartmouth | BB13.6 | Restricted | 47.718 |
| Dartmouth | BB13.6 | Restricted | 7.409 |
| Dartmouth | BB13.7 | Prohibited | 1.504 |
| Dartmouth | BB13.7 | Prohibited | 3.982 |
| Dartmouth | BB15.4 | Conditionally Approved | 329.862 |
| Dartmouth | BB15.5 | Conditionally Approved | 20.199 |
| Dartmouth | BB15.52 | Restricted | 69.858 |
| Dartmouth | BB15.7 | Restricted | 152.551 |
| Dartmouth | BB16.0 | Approved | 3798.14 |
| Dartmouth | BB5.0 | Approved | 840.483 |
| Dartmouth | BB6.0 | Prohibited | 197.078 |
| Dartmouth | BB7.0 | Approved | 1412.66 |
| Dartmouth | BB8.0 | Prohibited | 465.689 |
| Dartmouth | BB9.0 | Management Closure | 115.495 |
| Dartmouth | SC17.0 | Approved | 792.31 |
| Dartmouth | SC3.0 | Approved | 780.474 |
| Dartmouth | SC5.0 | Approved | 2175.899 |
| Dartmouth | SC8.0 | Approved | 4844.237 |
| Dartmouth | V12.0 | Approved | 0 |
| Fairhaven | BB14.0 | Approved | 130.757 |
| Fairhaven | BB14.2 | Prohibited | 75.694 |
| Fairhaven | BB14.3 | Conditionally Approved | 63.888 |
| Fairhaven | BB15.1 | Prohibited | 326.712 |
| Fairhaven | BB15.4 | Conditionally Approved | 1054.657 |
| Fairhaven | BB15.41 | Prohibited | 2.504 |
| Fairhaven | BB15.42 | Prohibited | 20.982 |
| Fairhaven | BB15.43 | Prohibited | 3.439 |
| Fairhaven | BB15.6 | Restricted | 21.057 |
| Fairhaven | BB15.7 | Restricted | 762.363 |
| Fairhaven | BB16.0 | Approved | 502.2 |
| Fairhaven | BB17.0 | Conditionally Approved | 568.255 |
| Fairhaven | BB18.0 | Approved | 174.01 |
| Fairhaven | BB18.1 | Conditionally Approved | 42.956 |
| Fairhaven | BB18.1R | Approved | 13.709 |
| Fairhaven | BB18.20 | Approved | 52.386 |
| Fairhaven | BB18.24 | Approved | 73.324 |
| Fairhaven | BB18.3 | Prohibited | 8.808 |
| Fairhaven | BB18.4R | Approved | 6.214 |
| Fairhaven | BB19.0 | Approved | 1067.197 |
| Fairhaven | BB20.0 | Approved | 101.552 |
| Fairhaven | BB21.0 | Approved | 699.146 |
| Fairhaven | BB21.20 | Approved | 31.959 |
| Fairhaven | BB21.3 | Prohibited | 18.09 |
| Fairhaven | BB21.4 | Approved | 26.279 |
| Fairhaven | BB22.1 | Prohibited | 20.765 |
| Fairhaven | BB22.20 | Conditionally Approved | 106.189 |
| Fairhaven | BB22.3 | Conditionally Approved | 172.027 |
| Freetown | MHB2.1 | Restricted | 232.758 |
| Freetown | MHB2.5 | Prohibited | 349.825 |
| Marion | BB24.0 | Approved | 145.925 |

| Town | Classification Area Code | Classification Type | Area (Acres) |
|--------------|---------------------------------|----------------------------|---------------------|
| Marion | BB28.0 | Approved | 849.814 |
| Marion | BB28.0 | Approved | 3459.394 |
| Marion | BB31.0 | Approved | 221.805 |
| Marion | BB31.1 | Prohibited | 22.485 |
| Marion | BB32.0 | Approved | 1502.768 |
| Marion | BB32.1 | Prohibited | 9.08 |
| Marion | BB32.11 | Prohibited | 0.308 |
| Marion | BB32.13 | Conditionally Approved | 224.784 |
| Marion | BB32.21 | Approved | 5.93 |
| Marion | BB32.22 | Approved | 16.304 |
| Marion | BB32.23 | Approved | 33.917 |
| Marion | BB32.3 | Prohibited | 10.817 |
| Marion | BB32.4 | Prohibited | 0.71 |
| Marion | BB32.5 | Prohibited | 0.772 |
| Marion | BB32.9 | Prohibited | 0.422 |
| Marion | BB33.0 | Approved | 1260.822 |
| Marion | BB34.0 | Approved | 203.575 |
| Marion | BB35.0 | Approved | 73.924 |
| Marion | BB35.4 | Prohibited | 27.075 |
| Marion | BB35.5 | Conditionally Approved | 53.744 |
| Mattapoisett | BB20.0 | Approved | 425.555 |
| Mattapoisett | BB21.0 | Approved | 715.905 |
| Mattapoisett | BB21.4 | Approved | 0 |
| Mattapoisett | BB23.0 | Approved | 137.339 |
| Mattapoisett | BB23.2 | Conditionally Approved | 0.598 |
| Mattapoisett | BB24.0 | Approved | 471.116 |
| Mattapoisett | BB25.0 | Approved | 1651.971 |
| Mattapoisett | BB25.11 | Prohibited | 66.89 |
| Mattapoisett | BB25.2 | Conditionally Approved | 55.467 |
| Mattapoisett | BB25.20 | Approved | 1.59 |
| Mattapoisett | BB25.4 | Prohibited | 2.246 |
| Mattapoisett | BB25.6 | Prohibited | 0.352 |
| Mattapoisett | BB25.7 | Prohibited | 2.242 |
| Mattapoisett | BB25.9 | Prohibited | 0.694 |
| Mattapoisett | BB26.1 | Conditionally Approved | 8.917 |
| Mattapoisett | BB26.2 | Restricted | 21.102 |
| Mattapoisett | BB26.3 | Restricted | 1.015 |
| Mattapoisett | BB27.0 | Prohibited | 26.884 |
| Mattapoisett | BB28.0 | Approved | 698.751 |
| Mattapoisett | BB29.0 | Approved | 121.916 |
| Mattapoisett | BB30.0 | Approved | 56.231 |
| Mattapoisett | BB30.1 | Prohibited | 3.931 |
| Mattapoisett | BB30.2 | Prohibited | 0.251 |
| Mattapoisett | BB31.0 | Approved | 75.391 |
| Mattapoisett | BB31.1 | Prohibited | 5.888 |
| New Bedford | BB11.2 | Prohibited | 152.573 |
| New Bedford | BB13.1 | Conditionally Approved | 240.272 |
| New Bedford | BB13.21 | Conditionally Approved | 36.953 |
| New Bedford | BB13.22 | Conditionally Approved | 69.794 |
| New Bedford | BB13.3 | Restricted | 0.076 |
| New Bedford | BB13.4 | Restricted | 135.437 |
| New Bedford | BB13.5 | Prohibited | 0.297 |

| Town | Classification Area Code | Classification Type | Area (Acres) |
|-------------|---------------------------------|----------------------------|---------------------|
| New Bedford | BB13.6 | Restricted | 93.132 |
| New Bedford | BB13.7 | Prohibited | 68.748 |
| New Bedford | BB14.2 | Prohibited | 176.077 |
| New Bedford | BB15.1 | Prohibited | 625.93 |
| New Bedford | BB15.5 | Conditionally Approved | 364.259 |
| New Bedford | BB15.51 | Prohibited | 15.382 |
| New Bedford | BB15.52 | Restricted | 142.905 |
| New Bedford | BB15.6 | Restricted | 107.179 |
| New Bedford | BB15.7 | Restricted | 305.342 |
| Plymouth | CCB38.0 | Approved | 0.159 |
| Plymouth | CCB39.0 | Approved | 15224.417 |
| Plymouth | CCB39.1 | Prohibited | 166.214 |
| Plymouth | CCB41.0 | Approved | 18241.233 |
| Plymouth | MB1.0 | Approved | 1449.072 |
| Sandwich | CCB35.0 | Approved | 11865.387 |
| Wareham | BB28.0 | Approved | 7.487 |
| Wareham | BB33.0 | Approved | 2161.739 |
| Wareham | BB33.0 | Approved | 863.079 |
| Wareham | BB35.0 | Approved | 68.096 |
| Wareham | BB35.1 | Prohibited | 20.045 |
| Wareham | BB35.2 | Prohibited | 123.817 |
| Wareham | BB35.4 | Prohibited | 29.239 |
| Wareham | BB35.5 | Conditionally Approved | 108.21 |
| Wareham | BB36.0 | Approved | 422.577 |
| Wareham | BB36.1 | Prohibited | 27.244 |
| Wareham | BB36.11 | Prohibited | 15.479 |
| Wareham | BB36.20 | Approved | 14.274 |
| Wareham | BB36.21 | Approved | 21.444 |
| Wareham | BB36.3 | Prohibited | 292.972 |
| Wareham | BB36.4 | Prohibited | 3.08 |
| Wareham | BB36.5 | Prohibited | 4.21 |
| Wareham | BB36.6 | Prohibited | 1.237 |
| Wareham | BB36.7 | Prohibited | 3.797 |
| Wareham | BB36.8 | Conditionally Approved | 63.733 |
| Wareham | BB36.9 | Prohibited | 24.663 |
| Wareham | BB37.0 | Approved | 153.864 |
| Wareham | BB38.0 | Approved | 188.915 |
| Wareham | BB39.0 | Approved | 187.115 |
| Wareham | BB40.0 | Approved | 393.935 |
| Wareham | BB40.20 | Conditionally Approved | 8.569 |
| Wareham | BB40.21 | Approved | 12.95 |
| Wareham | BB40.22 | Approved | 29.186 |
| Wareham | BB40.3 | Conditionally Approved | 95.816 |
| Wareham | BB41.0 | Approved | 76.204 |
| Wareham | BB41.2 | Conditionally Approved | 21.373 |
| Wareham | BB42.1 | Prohibited | 1.546 |
| Wareham | BB42.2 | Conditionally Approved | 62.496 |
| Wareham | BB42.3 | Conditionally Approved | 48.881 |
| Wareham | BB42.4 | Prohibited | 0.117 |
| Wareham | BB43.0 | Approved | 173.816 |
| Wareham | BB43.1 | Prohibited | 1.265 |
| Wareham | BB43.2 | Prohibited | 0.662 |

| Town | Classification Area Code | Classification Type | Area (Acres) |
|-------------|---------------------------------|----------------------------|---------------------|
| Wareham | BB43.4 | Conditionally Approved | 2.514 |
| Wareham | BB44.0 | Approved | 44.651 |
| Wareham | BB44.3 | Prohibited | 7.474 |
| Wareham | BB44.4 | Prohibited | 1.462 |
| Wareham | BB44.5 | Prohibited | 26.58 |
| Westport | BB1.0 | Approved | 3228.357 |
| Westport | BB1.0 | Approved | 12747.859 |
| Westport | BB2.0 | Prohibited | 46.43 |
| Westport | BB3.0 | Approved | 790.703 |
| Westport | BB3.11 | Conditionally Approved | 152.122 |
| Westport | BB3.12 | Conditionally Approved | 228.922 |
| Westport | BB3.13 | Approved | 3.682 |
| Westport | BB3.2 | Prohibited | 0.459 |
| Westport | BB3.3 | Prohibited | 114.163 |
| Westport | BB3.4 | Prohibited | 0.162 |
| Westport | BB3.5 | Conditionally Approved | 23.091 |
| Westport | BB3.6 | Prohibited | 8.258 |
| Westport | BB3.7 | Prohibited | 0.958 |
| Westport | BB3.8 | Prohibited | 102.816 |
| Westport | BB4.0 | Approved | 360.041 |
| Westport | BB4.1 | Prohibited | 3.386 |
| Westport | BB4.11 | Prohibited | 1.235 |
| Westport | BB4.13 | Conditionally Approved | 18.863 |
| Westport | BB4.2 | Prohibited | 410.628 |
| Westport | BB4.20 | Conditionally Approved | 10.435 |
| Westport | BB4.21 | Approved | 23.213 |
| Westport | BB4.23 | Approved | 2.19 |
| Westport | BB4.24 | Approved | 18.255 |
| Westport | BB4.4 | Prohibited | 1.705 |
| Westport | BB4.5 | Prohibited | 1.013 |
| Westport | BB4.6 | Prohibited | 0.781 |
| Westport | BB4.7 | Conditionally Approved | 532.736 |
| Westport | BB4.8 | Conditionally Approved | 407.72 |
| Westport | BB4.9 | Conditionally Approved | 180.218 |
| Westport | BB5.0 | Approved | 80.391 |
| Westport | BB5.0 | Approved | 4128.721 |
| Westport | BB7.0 | Approved | 88.547 |
| Westport | E4.0 | Approved | 0.026 |

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APPENDIX F- SUMMARY OF WMA PERMITTING INFORMATION, BUZZARDS BAY WATERSHED

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|------------------------|-------------------------|--|--------------------------|-----------|
| 95-04 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Churchill Reservoir | |
| 95-04 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Lincoln Reservoir | Carver |
| 95-04 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Pinewood Lake Reservoir | |
| 95-04 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Round Swamp Reservoir | |
| 95-04 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | South Howes Reservoir | Carver |
| 95-06 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Morse Swamp Reservoir | Rochester |
| 95-06 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Pierceville Reservoir | |
| 95-06 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Tremont Reservoir | |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Besse Reservoir | |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | East Branch Reservoir | |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | East Wareham Mill Pond | Wareham |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Engine House Reservoir | |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Fawn Pond | Plymouth |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Glen Charlie Reservoir | |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Glen Charlie Reservoir | Wareham |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Halfway Pond | |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Kennard-Eagle Hill Res. | Plymouth |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Long Pond | |
| 95-28 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | West Branch Reservoir | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | A. D. Makepeace Well #2 | Carver |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Alice Reservoir | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Carver Reservoir | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | East Head Reservoir | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Frog Foot Main Reservoir | Plymouth |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Frog Foot West Reservoir | Carver |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Golden Field Pond | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Hammond Reservoir | Carver |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|----------------------------|-------------------------|--------------------------------|---------------------------|----------------|
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Harwich Lower Reservoir | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Harwich Upper Reservoir | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Locke Reservoir | Wareham |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | New Mosquito Dam | Wareham |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Oak Swamp Reservoir | Plymouth |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Parker Mills Pond Res. | Plymouth |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Raccoon Pond | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Tihonet Pond | Wareham |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Tihonet Pond | Wareham |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Tihonet Pond Reservoir | Wareham |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | A. D. Makepeace Well #1 | Carver |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Bartlett's Marsh Pond | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Edwards Reservoir | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Slug Stream | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | White Island Pond | |
| 95-30 | 9P242431003 | 42431033 | | A.D. Makepeace Company | 12.36 | 0.73 | Marsh Bog | Wareham |
| 95-31 | 9P242400301 | | | Acushnet River Golf Course | | 0.1 | Irrigation Well | Acushnet |
| 95-04 | 9P242403602 | 42403603 | | Agawam Cranberry Company | 0.51 | 0.06 | South Meadow Bogs | Carver |
| 95-30 | 9P242403602 | 42403603 | | Agawam Cranberry Company | 0.51 | 0.06 | C P Bogs | Wareham |
| 95-30 | 9P242403602 | 42403603 | | Agawam Cranberry Company | 0.51 | 0.06 | Laine Bog | Wareham |
| 95-30 | 9P242403602 | 42403603 | | Agawam Cranberry Company | 0.51 | 0.06 | Reservoir (upper & Lower) | Buzzards Bay |
| 95-28 | | 42431024 | | Alan Grassi | 0.09 | 0 | Grassi Bog #1 | Wareham |
| 95-28 | | 42431024 | | Alan Grassi | 0.09 | 0 | Grassi Bog #2 | East Wareham |
| 95-15? | | 42203604 | | John M. Alden | 0.12 | 0 | C-1 Surface Supply | Monument Beach |
| 95-04 | | 42405233 | | Alex Johnson & Sons | 0.34 | 0 | Bates Pond Bog | So. Carver |
| 95-04 | | 42405233 | | Alex Johnson & Sons | 0.34 | 0 | Company Bogs | Carver |
| 95-04 | | 42405233 | | Alex Johnson & Sons | 0.34 | 0 | Maki Bog | Carver |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|-------------------------------------|-------------------------|--------------------------------|---------------------------|---------------|
| 95-04 | | 42418201 | | Anna's Bogs | 0.23 | 0 | Beach Street Reservoir #1 | Middleborough |
| 95-04 | | 42418201 | | Anna's Bogs | 0.23 | 0 | Beach Street Reservoir #2 | Middleborough |
| 95-04 | | 42429301 | | Annawon Council, Boy Scouts-America | 0.02 | 0 | Darby Pond | Plymouth |
| 95-04 | | 42405228 | | Austin B. Mason III | 0.08 | 0 | Sampson's Pond | South Carver |
| 95-01 | 9P442423903 | | | Atlantic Country Club | | 0.13 | Well #1 and well #2 | Plymouth |
| 95-04 | | 42423905 | | B & B Bogs | 0.05 | 0 | B&B Bogs | Plymouth |
| 95-05 | | 42405286 | | Bailey Bogs, Inc. | 0.26 | | Cranebrook | South Carver |
| 95-05 | | 42405286 | | Bailey Bogs, Inc. | 0.26 | | Pond (Wareham St.) | South Carver |
| 95-05 | | 42405286 | | Bailey Bogs, Inc. | 0.26 | | Reservoir (Cranberry Rd) | South Carver |
| 95-05 | | 42405286 | | Bailey Bogs, Inc. | 0.26 | | Well #1 | South Carver |
| 95-04 | | 42405259 | | Barry and Lorraine Olson | 0.37 | 0 | Cranberry Bogs #1 | Carver |
| 95-04 | | 42405259 | | Barry and Lorraine Olson | 0.37 | 0 | Cranberry Bogs #3 | Carver |
| 95-06 | | 42405259 | | Barry and Lorraine Olson | 0.37 | 0 | Cranberry Bogs #2 | Middleboro |
| 95-04 | | 42416902 | | Bartholomew Bogs | 0.38 | 0 | Weweantic River Bog | Plymouth |
| 95-30 | | 42416902 | | Bartholomew Bogs | 0.38 | 0 | Taber-Randall Reservoir | So. Carver |
| 95-30 | | 42416902 | | Bartholomew Bogs | 0.38 | 0 | Taber-Randall Well | So. Carver |
| 95-35 | 9P442417301 | | | Bay Club at Mattapoisett | | 0.26 | Irrigation Well E-3 | Mattapoisett |
| 953-35 | 9P442417301 | | | Bay Club at Mattapoisett | | 26 | Irrigation Well E-5 | Mattapoisett |
| 95-05 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Horseshoe Pond | Wareham |
| 95-06 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Eldridge Reservoirs | Rochester |
| 95-06 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Fran Le Baron Sump | Rochester |
| 95-06 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Sippican River | Rochester |
| 95-07 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | 14 Acre Well | Wareham |
| 95-07 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Blackmore Pond | Wareham |
| 95-07 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Eagle Holt Sumps | Wareham |
| 95-07 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Hariu Reservoir | Wareham |
| 95-07 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Sippican River (Marion) | Marion |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|------------|--------------|---------|------------------------------|-------------------------|--------------------------------|---------------------------|-----------------|
| 95-08 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Marion Bog Reservoirs | Marion |
| 95-29 | | 42431032 | | Bayside Agricultural Inc. | 0.7 | 0 | Parker Mills Reservoirs | Wareham |
| 95-04 | | 42405278 | | Beaton & LeBaron (Lind bogs) | 0.11 | 0 | Big Lind Reservoir | Middleborough |
| 95-04 | | 42405278 | | Beaton & LeBaron (Lind bogs) | 0.11 | 0 | Little Lind Reservoir | Middleborough |
| 95-04 | | 42405248 | | Beaver Dam Bog | 0.05 | 0 | Beaver Dam Bog | Carver |
| 95-04 | | 42405283 | | Benson Pond, Inc. | 0.17 | | Benson Pond Bogs | Middleboro |
| 95-09 | | 42416904 | | Betsy C. Grassi | 0.1 | 0 | Rocky Nook Bog | Marion |
| 95-04 | | V42431034 | | Betty L Myers | 0.04 | 0 | Wewantic River | Wareham |
| 95-06 | | V42431034 | | Betty L Myers | 0.04 | 0 | High St. Bog(Rochester) | Rochester |
| 95-04 | | 42418214 | | Big Rock Farm, Inc. | 0.14 | 0 | Big Rock Bogs | So. Middleboro |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Sta. #1(has 4 wells) | Monument Beach |
| 95-18 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #2 | Cataumet |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Sta. #3 State forest | Monument Beach |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #4 | Monument Beach |
| 95-18 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #5 | Cataumet |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #6 | Pocasset |
| 95-30 | | 42405260 | | Bowers and Russell | 0.3 | 0 | East Head Reservoir | Plymouth/Carver |
| 95-36 | | 42425022 | | Bryan Sherman | 0.05 | 0 | Gifford St. | Rochester |
| 95-04 | | 42405280 | | Burgess Bog Company, Inc. | 0.23 | 0 | Burgess Bog | Carver |
| 95-04 | | 42405280 | | Burgess Bog Company, Inc. | 0.23 | 0 | Burgess Well | Carver |
| 95-01 | 9P42403601 | 42403606 | 4036001 | Buzzards Bay Water District | 0.37 | 0.16 | Pumping Station #1 | Buzzards Bay |
| 95-01 | 9P42403601 | 42403606 | 4036001 | Buzzards Bay Water District | 0.37 | 0.16 | Pumping Station #2 | Buzzards Bay |
| 95-01 | 9P42403601 | 42403606 | 4036001 | Buzzards Bay Water District | 0.37 | 0.16 | Pumping Station #3 | Buzzards Bay |
| 95-01 | 9P42403601 | 42403606 | 4036001 | Buzzards Bay Water District | 0.37 | 0.16 | Pumping Station #4 | Buzzards Bay |
| 95-06 | | 42418206 | | C & L Trust-Stanley Lowell | 0.18 | 0 | Wareham Street Reservoir | So. Middleboro |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|--------------------------------------|-------------------------|--------------------------------|------------------------|--------------|
| 95-01 | | 42403604 | | Cape American Cranberry Corporation | 0.12 | 0 | McMahon Bog | Buzzards Bay |
| | | 42417303 | | Carl Hubacheck | 0.14 | | | |
| 95-06 | | 42425009 | | Carr Family Limited Partnership | 0.15 | 0 | Leonards' Pond | Rochester |
| 95-06 | | 42425009 | | Carr Family Limited Partnership | 0.15 | 0 | Mary's Pond | Rochester |
| 95-04 | | 42423907 | | Carter Cranberry | 0.04 | 0 | Pinewood Lane Bogs | Plymouth |
| | | 42405231 | | Carver Cranberries, Corporation | 0.09 | 0 | Edaville RR Bogs | Carver |
| 95-04 | 9P242405205 | 42431044 | | Carver/Middleboro Cranberry Co., Inc | 0.33 | 0.16 | Bog Pond | Middleboro |
| 95-07 | | 42431030 | | Cedar Meadows Trust of 1990 | 0.05 | 0 | S-1 Reservoir | West Wareham |
| 95-07 | | 42431030 | | Cedar Meadows Trust of 1990 | 0.05 | 0 | S-2 Reservoir | West Wareham |
| 95-07 | | 42431030 | | Cedar Meadows Trust of 1990 | 0.05 | 0 | S-3 Reservoir | West Wareham |
| 95-04 | | 42405210 | | Cedar Swamp Bog Company | 0.08 | 0 | Cedar Swamp Bog | Carver |
| 95-04 | | 42405210 | | Cedar Swamp Bog Company | 0.08 | 0 | Formerly Pierce Bog | South Carver |
| 95-04 | | 42405244 | | Cedarbrook Cranberry Harvest | 0.09 | 0 | Cedarbrook Reservoir | Carver |
| 95-04 | | 42405218 | | Charles R. Johnson | 0.23 | 0 | Fosdick Road Bogs | Carver |
| 95-04 | | 42405256 | | Charles W. Garnett | 0.21 | 0 | Popes Point Bog | Carver |
| 95-04 | | 42431027 | | Clear Pond Bogs | 0.15 | 0 | Clear Pond #1 Well | So. Carver |
| 95-04 | | 42431027 | | Clear Pond Bogs | 0.15 | 0 | Clear Pond Bogs | So. Carver |
| 95-04 | | 42431027 | | Clear Pond Bogs | 0.15 | 0 | Lincoln's Duck Dinner | So. Carver |
| 95-11 | 9P42407202 | | | Country Club of New Bedford | | 0.19 | | |
| 95-06 | | 42431037 | | County Road Bog | 0.05 | 0 | County Road Bog | Rochester |
| 95-06 | | 42431037 | | County Road Bog | 0.05 | 0 | High Street Bog | Rochester |
| | | 42405284 | | Cousins Cranberry Company LLC | 0.05 | | | |
| 95-04 | | V42405281 | | Craig Weston (Simeone Bog) | 0.04 | 0 | Simeone Bog | Carver |
| 95-04 | | 42405252 | | Cranberry Country Bogs | 0.21 | 0 | Cranberry Country Bogs | Carver |
| 95-05 | | 42431051 | | Cross Neck Bog (Frank Cerkovitz) | 0.05 | 0 | Cross Neck Bog | Marion |
| 95-04 | | 42405212 | | Curtis T. Young | 0.06 | 0 | Bates Pond | Carver |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|---------|-------------------------------|-------------------------|--------------------------------|------------------------|------------------|
| 95-04 | | 42405212 | | Curtis T. Young | 0.06 | 0 | Weweantic River | Carver |
| 95-04 | | 42419602 | | D. Melville Cranberry Bogs | 0.02 | 0 | Melville Bog #1 | Plymouth |
| 95-04 | | 42419602 | | D. Melville Cranberry Bogs | 0.02 | 0 | Melville Bog #2 | Plymouth |
| 95-04 | | 42431006 | | Dana C. Johnson | 0.08 | 0 | D. Johnson Reservoir | Middleboro |
| 95-04 | | 42405232 | | Daniel J Bryden | 0.03 | 0 | Shurtleff Corner Bog | Carver |
| 95-04 | | 42431021 | | Daniel Johnson Cranberry Bogs | 0.14 | 0 | France Street Bog | Middleboro |
| 95-04 | | 42431021 | | Daniel Johnson Cranberry Bogs | 0.14 | 0 | Shurtleff Bog | Carver & Wareham |
| 95-12 | 9P242407203 | 42420102 | | Dartmouth Cranberry Company | 0.11 | 0.1 | Dartmouth Bogs | Dartmouth |
| 95-12 | 9P242407203 | 42420102 | | Dartmouth Cranberry Company | 0.11 | 0.1 | Reservoir | New Bedford |
| 95-40 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Route 6 Well | Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Chase Road D | North Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Chase Road E-1 | North Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Chase Road E-2 | North Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Chase Road Well A | Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Chase Road Well B | Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Chase Road Well C | Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Violetta #2 | North Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Violetta #3 | North Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Violetta Well | Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Well F-1 | North Dartmouth |
| 95-11 | 9P242407201 | 42407202 | 4072000 | Dartmouth Water Department | 1.35 | 2.11 | Well F-2 | North Dartmouth |
| 95-04 | | 42405263 | | Dave M. Cowan | 0.04 | 0 | So. Meadow Brook Pond | Carver |
| 95-04 | | 42405243 | | David A. Lawson | 0.04 | 0 | South Meadow Road Well | Carver |
| 95-04 | | V42418217 | | David J. Erickson | 0.04 | 0 | David J. Erickson | Middleboro |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|-------------------------------|-------------------------|--------------------------------|--------------------------|--------------|
| 95-04 | | 42431041 | | David W & Eleanor M. Eldredge | 0.16 | 0 | Eldredge Bogs | So. Carver |
| 95-04 | | 42405261 | | Davison Partners | 0.23 | 0 | Mayflower Road Reservoir | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Carver 5+7 | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Decas #2 | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Decas #3 | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Decas #4 | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Decas Reservoir #1 | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Decas Well #1 | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Decas Well #2 | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Dunham Pond | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Swamp Reservoir | Carver |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Unnamed Irrigation Pond | Wareham |
| 95-04 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Unnamed Reservoir | Wareham |
| 95-06 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Clapp Road Reservoir | Rochester |
| 95-06 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Mary's Pond | Rochester |
| 95-06 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Mary's Pond | Wareham |
| 95-06 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Pierceville Reservoir | Rochester |
| 95-06 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Stuart Pond #2 | Rochester |
| 95-36 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Long Pond | Rochester |
| 95-36 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Long Pond #2 | Rochester |
| 95-36 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Long Pond #3 | Rochester |
| 95-36 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Mattapoisett #1 | Mattapoisett |
| 95-36 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Mattapoisett #2 | Mattapoisett |
| 95-36 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Mattapoisett #3 | Mattapoisett |
| 95-36 | 9P442431004 | 42431016 | | Decas Cranberry Company, Inc. | 3.06 | 0.11 | Stuart Pond | Rochester |
| 95-31 | | 42423904 | | Dietlin Bogs, Inc. | 0.13 | 0 | Dietlin Bogs | E. Freetown |
| 95-01 | | 42431017 | | Donald F. Grassi Cranberries | 0.2 | 0 | Little Rocky-Whites Pond | Plymouth |
| 95-01 | | 42431017 | | Donald F. Grassi Cranberries | 0.2 | 0 | Long Duck Pond | West Wareham |

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|---------|-------------|--------------|-------|------------------------------------|-------------------------|--------------------------------|--------------------------|--------------|
| 95-01 | | 42431017 | | Donald F. Grassi Cranberries | 0.2 | 0 | Well #1 | West Wareham |
| 95-04 | | 42431003 | | Double Brook Cranberry Corporation | 0.15 | 0 | Double Brook Reservoir | Middleboro |
| 95-06 | | 42431019 | | Double M Cranberry Company, Inc. | 0.34 | 0 | Double M Well #1 | Rochester |
| 95-36 | | 42431019 | | Double M Cranberry Company, Inc. | 0.34 | 0 | Double M Reservoir #1 | Rochester |
| 95-36 | | 42431019 | | Double M Cranberry Company, Inc. | 0.34 | 0 | Double M Reservoir #2 | Rochester |
| 95-36 | | 42431019 | | Double M Cranberry Company, Inc. | 0.34 | 0 | Double M Well #2 | Rochester |
| 95-36 | | 42431019 | | Double M Cranberry Company, Inc. | 0.34 | 0 | Double M Well #3 | Rochester |
| | 9P242405204 | | | Double T Bog Co, Inc. | | 0.04 | Double T Bog | South Carver |
| 95-06 | | 42425020 | | EAC SEMASS (Cranberry Bog) | 0.06 | 0 | Semass Reservoir | Rochester |
| | | 42431062 | | Eagle Holt Company, Inc. | 1.1 | | | |
| | | 42425023 | | Edgewater Bogs Realty Trust | 0.08 | 0 | Snipatuit Pond-Maxim Bog | Rochester |
| 95-04 | 9P242405207 | 42405267 | | Edgewood Bogs | 1.76 | 0.01 | Atwood Bog A&B-Edgewood | Carver |
| 95-04 | 9P242405207 | 42405267 | | Edgewood Bogs | 1.76 | 0.01 | Cranebrook Bog-Edgewood | Carver |
| | 9P242405207 | 42405267 | | Edgewood Bogs | 1.76 | 0.01 | South Meadow Bog | Carver |
| 95-04 | | 42424001 | | Edgewood bogs, LLC | 0.5 | 0 | Queen Bog | Carver |
| 95-30 | | 42425001 | | Edward Ashley | 0.62 | 0 | Rosebrook Well | Wareham |
| 95-30 | | 42425001 | | Edward Ashley | 0.62 | 0 | Alley Bog | Rochester |
| 95-30 | | 42425001 | | Edward Ashley | 0.62 | 0 | Clark Bog | Rochester |
| 95-30 | | 42425001 | | Edward Ashley | 0.62 | 0 | Rosebrook Bog | Rochester |
| 95-04 | | 42405238 | | Edward Silva Jr. | 0.09 | 0 | Old Center Street Bog | Carver |
| 95-04 | | 42405219 | | Edwin K. & Elaine J. Harju | 0.04 | 0 | Popes Point Road Bog | Carver |
| 95-04 | | 42405241 | | Eino F. Harju Trust | 0.14 | 0 | Tremont Street Pond | Carver |
| 95-04 | | 42405257 | | Ellis D. Atwood, Inc. | 2.33 | 0 | Atwood Bogs | So. Carver |
| 95-04 | | 42405257 | | Ellis D. Atwood, Inc. | 2.33 | 0 | Shoe String Bog | So. Carver |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|------------|--------------|---------|-----------------------------------|-------------------------|--------------------------------|--|--------------------|
| 95-04 | | 42405230 | | Elsie J. Johnson | 0.09 | 0 | Main Street Bog | Carver |
| 95-30 | | 42405230 | | Elsie J. Johnson | 0.09 | 0 | Southwest Line Bog | Plymouth |
| 95-04 | | 42423903 | | Eric Haarala | 0.13 | 0 | France and Pope Pond | Carver |
| 95-04 | | 42423903 | | Eric Haarala | 0.13 | 0 | France Street Pond | Middleboro |
| 95-04 | | 42418215 | | Erickson Bogs | 0.23 | 0 | Erickson Bogs | Middleboro |
| 95-35 | 9P42409401 | 42409401 | 4094000 | Fairhaven Water Department | 1.07 | 0.69 | Mattapoissett-Tubular | Mattapoissett |
| NA | 9P42409401 | 42409401 | 4094000 | Fairhaven Water Department | 1.07 | 0.69 | Nasketucket Tubular Wells | Fairhaven |
| 95-36 | 9P42409401 | 42409401 | 4094000 | Fairhaven Water Department | 1.07 | 0.69 | Tinkham Lane GP | Fairhaven |
| 95-36 | 9P42409401 | 42409401 | 4094000 | Fairhaven Water Department | 1.07 | 0.69 | Well #1-Wolf Island Road | Mattapoissett |
| 95-36 | 9P42409401 | 42409401 | 4094000 | Fairhaven Water Department | 1.07 | 0.69 | Well #2-Wolf Island Road | Mattapoissett |
| 95-36 | 9P42409401 | 42409401 | 4094000 | Fairhaven Water Department | 1.07 | 0.69 | Well #3-Wolf Island Road | Mattapoissett |
| 95-43 | | 42409501 | 4095000 | Fall River Water Department | 6.37 | 0 | 4095000-03S | |
| 95-23 | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Long Pond Reservoir | Falmouth |
| 95-24 | | | | | | | | |
| 95-23? | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Mares Pond Well | Falmouth |
| 95-22 | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Crooked Pond Well | Falmouth |
| --- | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Fresh Pond Well & Coonamessett Pond Well | Cape Cod Watershed |
| 95-07 | | 42416903 | | Farrell Cranberry Company | 0.06 | 0 | Sippican River Bog | Marion |
| 95-01 | | 42405209 | | Federal Furnace Cranberry Company | 2.14 | 0 | Bourne Road Well | Plymouth |
| 95-01 | | 42405209 | | Federal Furnace Cranberry Company | 2.14 | 0 | Ware Bog | Plymouth |
| 95-04 | | 42405209 | | Federal Furnace Cranberry Company | 2.14 | 0 | Federal Pond | Carver |
| 95-04 | | 42405246 | | Fiilus Harju Cranberry Co. | 0.05 | 0 | Meadow Street Bog | Carver |
| 95-04 | | 42405249 | | Flax Pond Cranberry Company | 0.22 | 0 | Flax Pond | Carver |
| 95-04 | | 42405217 | | Francis V. Johnson | 0.07 | 0 | Cross Street Bog | Carver |
| 95-04 | | 42405217 | | Francis V. Johnson | 0.07 | 0 | Forest Street Bog | Carver |
| 95-07 | | 42431010 | | Frank & Patricia Kaasinen | 0.07 | 0 | Squirrel Island Bog | West Wareham |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|----------------------------------|-------------------------|--------------------------------|---------------------------|--------------------|
| 95-07 | | 42431010 | | Frank & Patricia Kaasinen | 0.07 | 0 | Squirrel Island Reservoir | West Wareham |
| 95-31 | | 42410205 | | Frank H. Ashley | 0.04 | 0 | Ashley Reservoir | East Freetown |
| 95-04 | | 42405214 | | Frederick & Virginia Weston | 0.15 | 0 | Holmes Street Reservoir | Carver |
| 95-04 | | 42405214 | | Frederick & Virginia Weston | 0.15 | 0 | Wade Street Well | Carver |
| 95-04 | | 42405214 | | Frederick & Virginia Weston | 0.15 | 0 | Wade Street Bog | Carver |
| 95-31 | | 42410209 | | Fruit of the Vine Cranberry Co. | 0.14 | 0 | Acushnet Bog | Acushnet |
| 95-31 | | 42410209 | | Fruit of the Vine Cranberry Co. | 0.14 | 0 | Freetown Bog | East Freetown |
| 95-04 | | 42405268 | | Gary F. Weston | 0.27 | 0 | Weston Reservoir #1 | Carver |
| 95-04 | | 42405268 | | Gary F. Weston | 0.27 | 0 | Weston Reservoir #2 | Carver |
| 95-04 | | 42405268 | | Gary F. Weston | 0.27 | 0 | Weston Reservoir #3 | Carver |
| 95-04 | | 42405268 | | Gary F. Weston | 0.27 | 0 | Weston Reservoir #4 | Carver |
| 95-04 | | 42405268 | | Gary F. Weston | 0.27 | 0 | Weston Well | Carver |
| 95-06 | | 42418202 | | Gates Cranberry L.L.C. | 0.31 | 0 | Spruce Street Bogs | So. Middleborough |
| 95-31 | | 42418202 | | Gates Cranberry L.L.C. | 0.31 | 0 | Braley Bogs | Freetown |
| 95-04 | 9P242405206 | 42405226 | | Gilmore Cranberry Co., Inc. | 0.51 | 0.13 | South Carver Bog | South Carver |
| 95-04 | 9P242405206 | 42405226 | | Gilmore Cranberry Co., Inc. | 0.51 | 0.13 | Thomas Bog-B. Gilmore | S. Carver |
| 95-36 | 9P242405206 | 42405226 | | Gilmore Cranberry Co., Inc. | 0.51 | 0.13 | Gilmore Bogs 1, 2 & 3 | Rochester |
| 95-36 | 9P242405206 | 42405226 | | Gilmore Cranberry Co., Inc. | 0.51 | 0.13 | Snows Pond Bog-Gilmore | Rochester |
| | 9P242405206 | 42405226 | | Gilmore Cranberry Co., Inc. | 0.51 | 0.13 | S. Carver Bogs-B. Gilmore | S. Carver |
| | 9P242405206 | 42405226 | | Gilmore Cranberry Co., Inc. | 0.51 | 0.13 | Thomas Bog | South Carver |
| 95-06 | 9P242425002 | 42431049 | | Great Bear Farms, Inc. | 0.3 | 0.18 | Great Neck Bogs | Rochester |
| 95-06 | 9P242425002 | 42431049 | | Great Bear Farms, Inc. | 0.3 | 0.18 | Bogs 5 - 13 (Pond #3) | Rochester |
| 95-06 | 9P242425002 | 42431049 | | Great Bear Farms, Inc. | 0.3 | 0.18 | Bogs 5 - 13 (Pond #4) | Rochester |
| 95-06 | 9P242425002 | 42431049 | | Great Bear Farms, Inc. | 0.3 | 0.18 | Bogs 5 - 13 (Pond 1 & 2) | Rochester |
| 95-04 | | 42405247 | | Griffith Cranberry Company, Inc. | 0.23 | 0 | Indian Street Bog | So. Carver |
| 95-18 | | 42209609 | | Handy Cranberry Trust | 2.08 | 0 | Wells #1 & #2 | Cataumet |
| --- | | 42209609 | | Handy Cranberry Trust | 2.08 | 0 | Cranberry Bogs (11G & 2S) | Cape Cod Watershed |

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|---------|-------------|--------------|-------|------------------------------------|-------------------------|--------------------------------|---------------------------|------------|
| 95-04 | | 42418212 | | Hariju Bros. Cranberries, Inc. | 0.24 | 0 | Beaver Dam River | Carver |
| 95-04 | | 42418212 | | Hariju Bros. Cranberries, Inc. | 0.24 | 0 | Bent Bog | Carver |
| 95-07 | | 42416907 | | Hariju Cranberry Bogs | 0.09 | 0 | County Road Reservoir | Marion |
| 95-07 | | 42416907 | | Hariju Cranberry Bogs | 0.09 | 0 | Squirrel Island Reservoir | W. Wareham |
| | 9P342425003 | | | Hartley-Rhodes, Inc. | | 0.07 | Hartley-Rhodes Bogs | Rochester |
| 95-04 | | 42405269 | | Heikkila Cranberry Bogs | 0.14 | 0 | Heikkila Well #2 | Carver |
| 95-04 | | 42405269 | | Heikkila Cranberry Bogs | 0.14 | 0 | Heikkita Bog #1 | Carver |
| 95-04 | | 42405269 | | Heikkila Cranberry Bogs | 0.14 | 0 | Heikkita Bog #2 | Carver |
| 95-04 | | 42405269 | | Heikkila Cranberry Bogs | 0.14 | 0 | Heikkita Bog #3 | Carver |
| 95-04 | | 42405269 | | Heikkila Cranberry Bogs | 0.14 | 0 | Heikkita Well #1 | Carver |
| 95-04 | | 42405269 | | Heikkila Cranberry Bogs | 0.14 | 0 | Heikkita Well #3 | Carver |
| 95-04 | | 42418203 | | Heinz Cranberries, Inc. | 0.06 | 0 | Heinz Bogs | Carver |
| 95-29 | | 42431035 | | Herbert Ashley | 0.55 | 0 | Mill Pond | E. Wareham |
| 95-04 | | 42431038 | | High Line Bog | 0.05 | 0 | High Line Bog | W. Wareham |
| 95-06 | | 42425007 | | Hiller Brothers, Inc. | 0.9 | 0 | Hathaway Mill Pond | Rochester |
| 95-06 | | 42425007 | | Hiller Brothers, Inc. | 0.9 | 0 | Leonards Pond | Rochester |
| 95-06 | | 42425007 | | Hiller Brothers, Inc. | 0.9 | 0 | Leonards' Pond | Rochester |
| 95-04 | | 42425008 | | Hiller Cranberries, Inc. | 0.42 | 0 | Wenham Pond | Carver |
| 95-04 | | 42425008 | | Hiller Cranberries, Inc. | 0.42 | 0 | Weweantic River | Carver |
| 95-29 | | 42431048 | | James Ashley | 0.82 | 0 | Bangs Bog | Wareham |
| 95-04 | | 42418216 | | James DiBurgo | 0.58 | 0 | Rocky Meadow Bog #1 | Middleboro |
| 95-04 | | 42418216 | | James DiBurgo | 0.58 | 0 | Rocky Meadow Bog #2 | Middleboro |
| 95-04 | | 42418216 | | James DiBurgo | 0.58 | 0 | Rocky Meadow Bog #3 | Middleboro |
| 95-04 | | 42418216 | | James DiBurgo | 0.58 | 0 | Rocky Meadow Bog #4 | Middleboro |
| 95-04 | | 42431061 | | James E Croke | 0.22 | 0 | James Croke-Weweantic R. | Wareham |
| 95-04 | | 42405251 | | James F. & Maureen M. Shephard Jr. | 0.07 | 0 | Bow Street Bog | Carver |
| 95-04 | | 42405251 | | James F. & Maureen M. Shephard Jr. | 0.07 | 0 | Bow Street Well #1 | Carver |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|-------------------------------------|-------------------------|--------------------------------|--------------------------|------------------|
| 95-04 | | 42405251 | | James F. & Maureen M. Shephard Jr. | 0.07 | 0 | Bow Street Well #2 | Carver |
| 95-31 | | 42410207 | | James L. Lopes | 0.05 | 0 | Lapes Reservoir | East Freetown |
| 95-04 | | 42419603 | | John G. Shurtleff, Jr. | 0.05 | 0 | Weweantic River | |
| 95-04 | | 42405282 | | Joseph Krystofolski | 0.2 | 0 | Meadow Street Bog | Carver |
| 95-04 | | 42405282 | | Joseph Krystofolski | 0.2 | 0 | Pine Street Bog | Carver |
| | | 42405287 | | Jungle Bog (Roger W. Shores) | 0.07 | | | |
| 95-04 | | 42405211 | | Kallio Bogs | 0.66 | 0 | Kallio Bog #1 | So. Carver |
| 95-04 | | 42405211 | | Kallio Bogs | 0.66 | 0 | Kallio Bog #2 | So. Carver |
| 95-04 | | 42405211 | | Kallio Bogs | 0.66 | 0 | Kallio Well #2 | So. Carver |
| 95-04 | | 42405211 | | Kallio Bogs | 0.66 | 0 | Tremont Street Well #1 | So. Carver |
| 95-06 | | 42425024 | | Karl J. Ashley III & Wendy Ashley | 0.43 | | Rosebrook Bog | Rochester |
| | | V42400303 | | Keith' Tree Farm & Nursery | 0.06 | 0 | | |
| 95-04 | | 42418205 | | Ken Harju & Sons Cranberries, Inc. | 0.66 | 0 | France Street Reservoir | Middleboro |
| 95-04 | | 42418205 | | Ken Harju & Sons Cranberries, Inc. | 0.66 | 0 | Old Center St. Bogs | Carver |
| | 9P242407202 | | | King Fisher Corp. | | 0.11 | Pond A (Bogs 1-6 & 9) | Dartmouth |
| | 9P242407202 | | | King Fisher Corp. | | 0.11 | Pond B (Bogs 7 & 8) | Dartmouth |
| 95-04 | | 42405216 | | Lakeville Redi-Mix/Lakeside Crushin | 0.28 | 0 | Tremont Street Well | South Carver |
| 95-04 | | 42405216 | | Lakeville Redi-Mix/Lakeside Crushin | 0.28 | 0 | Tremont Street Reservoir | South Carver |
| 95-31 | | 42410203 | | Lakewood Cranberry Co., Inc. | 0.23 | 0 | Freetown Bog Reservoir | East Freetown |
| 95-31 | | 42410203 | | Lakewood Cranberry Co., Inc. | 0.23 | 0 | Lakewood Reservoir | Acushnet |
| 95-06 | | 42418210 | | Laurance S. Cowan | 0.04 | 0 | Cowan Reservoir | Middleboro |
| 95-04 | | 42405220 | | Leonard A. Pierce | 0.07 | 0 | Rocky Meadow Reservoir | Middleboro |
| 95-04 | | 42405220 | | Leonard A. Pierce | 0.07 | 0 | Wareham Street Bog | South Carver |
| 95-06 | | 42405220 | | Leonard A. Pierce | 0.07 | 0 | Route 28 and 429 Bog | South Middleboro |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|------------|--------------|---------|------------------------------------|-------------------------|--------------------------------|-----------------------|--------------|
| 95-04 | | 42431018 | | Line Bog Cranberries | 0.13 | 0 | Line Bog Reservoir | Carver |
| 95-04 | | 42431018 | | Line Bog Cranberries | 0.13 | 0 | Line Bog Well Pump | Carver |
| 95-31 | | 42400301 | | Long Plain Cranberry Company, Inc. | 0.04 | 0 | Weston Bogs | Acushnet |
| 95-04 | | 42426401 | | Lunar Berries Company | 0.14 | 0 | Lunar Bogs | Carver |
| 95-06 | | 42416908 | | Magnolia Cranberry Company | 0.05 | 0 | Wiles Irrigation Sump | Marion |
| 95-29 | | 42431014 | | Makepeace FH Acquisition Corp. | 0.9 | 0 | Agawam Bog Reservoir | Wareham |
| 95-29 | | 42431014 | | Makepeace FH Acquisition Corp. | 0.9 | 0 | Fuller Well #31 | Wareham |
| 95-30 | | 42431014 | | Makepeace FH Acquisition Corp. | 0.9 | 0 | Smalley Bog Reservoir | Wareham |
| 95-30 | | 42431014 | | Makepeace FH Acquisition Corp. | 0.9 | 0 | Fuller Well #1 | Wareham |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Reservoir #1 | Buzzards Bay |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Reservoir #2 | Buzzards Bay |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Reservoir #3 | Buzzards Bay |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Reservoir #4 | Buzzards Bay |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Reservoir #5 | Buzzards Bay |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Well #1 | Buzzards Bay |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Well #2 | Buzzards Bay |
| 95-01 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Bay Road Well #3 | Buzzards Bay |
| 95-05 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Route 6 Reservoir #2 | Wareham |
| 95-05 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Route 6 Reservoir #3 | Wareham |
| 95-05 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Route 6 Well | Wareham |
| 95-30 | | 42403605 | | Mann Farms Inc. | 1.22 | 0 | Route 6 Reservoir #1 | Wareham |
| 95-28 | | 42431040 | | Maple Park Properties, Inc. | 0.29 | 0 | Maple Park Reservoir | E. Wareham |
| 95-06 | | 42425012 | | Maranatha Growers | 0.06 | 0 | Maranatha Bog | Rochester |
| 95-06 | 9P42416901 | 42416910 | 4169000 | Marion Water Division | 0.56 | 0.18 | East Well | Rochester |
| 95-06 | 9P42416901 | 42416910 | 4169000 | Marion Water Division | 0.56 | 0.18 | Main Water Station #1 | Marion |
| 95-06 | 9P42416901 | 42416910 | 4169000 | Marion Water Division | 0.56 | 0.18 | Mary's Pond Station | Rochester |
| 95-36 | 9P42416901 | 42416910 | 4169000 | Marion Water Division | 0.56 | 0.18 | North Well | Marion |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|------------|--------------|---------|------------------------------------|-------------------------|--------------------------------|-----------------------|-------------------|
| 95-36 | 9P42416901 | 42416910 | 4169000 | Marion Water Division | 0.56 | 0.18 | South Well | |
| 95-06 | 9P42416901 | 42416910 | 4169000 | Marion Water Division | 0.56 | 0.18 | West Well | Rochester |
| 95-36 | 9P42416901 | 42416910 | 4169000 | Marion Water Division | 0.56 | 0.18 | Wolf Island Station | Rochester |
| 95-09 | | 42416901 | | Marion, Town of (Cranberry Bogs) | 0.06 | 0 | Goldovitz Bog | Marion |
| 95-04 | | 42405255 | | Mark F. Weston | 0.11 | 0 | France Street Bog #1 | Middleboro |
| 95-04 | | 42405255 | | Mark F. Weston | 0.11 | 0 | France Street Bog #2 | Carver |
| 95-04 | | 42405255 | | Mark F. Weston | 0.11 | 0 | Main Street Bog | Carver |
| 95-06 | | 42431009 | | Mary Fava | 0.12 | 0 | Fava Reservoir | So. Middleborough |
| 95-36 | 9P42417301 | 42417301 | 4173000 | Mattapoisett Water & Sewer Dept. | 0.42 | 0.39 | Station #2 | Mattapoisett |
| 95-36 | 9P42417301 | 42417301 | 4173000 | Mattapoisett Water & Sewer Dept. | 0.42 | 0.39 | Station #3 | Mattapoisett |
| 95-36 | 9P42417301 | 42417301 | 4173000 | Mattapoisett Water & Sewer Dept. | 0.42 | 0.39 | Station #4 | Mattapoisett |
| 95-36 | 9P42417301 | 42417301 | 4173000 | Mattapoisett Water & Sewer Dept. | 0.42 | 0.39 | Station #5 | Mattapoisett |
| 95-36 | 9P42417301 | 42417301 | 4173000 | Mattapoisett Water & Sewer Dept. | 0.42 | 0.39 | 4173000-01G | Mattapoisett |
| 95-02 | | 42431050 | | Matthew N. Rhodes | 0.05 | 0 | Rhodes Well | Wareham |
| 95-02 | | 42431050 | | Matthew N. Rhodes | 0.05 | 0 | Rhodes Bogs | Wareham |
| 95-04 | | 42405225 | | Meadow Pond Farm | 0.09 | 0 | Ward Street Reservoir | Carver |
| 95-04 | | 42405225 | | Meadow Pond Farm | 0.09 | 0 | Ward Street Well | Carver |
| 95-06 | | 42425017 | | Mello-Wilson Cranberry Corporation | 0.18 | 0 | Burgess Avenue Bog | Rochester |
| 95-14 | | 42425017 | | Mello-Wilson Cranberry Corporation | 0.18 | 0 | Neck Pond Bog | Rochester |
| 95-35 | | 42425017 | | Mello-Wilson Cranberry Corporation | 0.18 | 0 | County Road Bog #1 | Mattapoisett |
| 95-35 | | 42425017 | | Mello-Wilson Cranberry Corporation | 0.18 | 0 | County Road Bog #2 | Mattapoisett |
| 95-11 | | 42410204 | | Michael G. Ashley | 0.4 | 0 | Ashley Bog #1 | New Bedford |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|---------|--------------------------------|-------------------------|--------------------------------|--|---------------|
| 95-12 | | 42410204 | | Michael G. Ashley | 0.4 | 0 | Ashley Bog #2 | No. Dartmouth |
| 95-14 | | 42226109 | | Mirant Canal, LLC | 0.45 | 0 | Freezer Rd Well #1 Freezer Rd Well #2 | Sandwich |
| | 9P242400303 | | | Moniz Estates | | 0.14 | Headwater Reservoir | Acushnet |
| | 9P242400303 | | | Moniz Estates | | 0.14 | Reservoir/Tailwater Pond | Acushnet |
| 95-06 | | 42425006 | | Morse Bros. Inc. | 0.49 | 0 | Morse Brothers Bog | Rochester |
| 95-06 | | 42431039 | | Morse Swamp Bog | 0.14 | 0 | Morse Swamp Bog #1 | Rochester |
| 95-06 | | 42431039 | | Morse Swamp Bog | 0.14 | 0 | Morse Swamp Bog #2 | Marion |
| 95-06 | | 42425021 | | N.H.T. Corporation | 0.08 | 0 | West Branch Sippican R. | Rochester |
| 95-04 | | 42405227 | | Nathaniel F. Shurtleff, Jr. | 0.23 | 0 | Rochester Road Reservoir | South Carver |
| 95-04 | 9P242405203 | 42405270 | | Oiva Hannula & Sons, Inc. | 1 | 0.15 | Bailey Bog | Carver |
| 95-04 | 9P242405203 | 42405270 | | Oiva Hannula & Sons, Inc. | 1 | 0.15 | Goddard Bogs | Middleboro |
| 95-04 | 9P242405203 | 42405270 | | Oiva Hannula & Sons, Inc. | 1 | 0.15 | Home Bogs | Carver |
| 95-04 | 9P242405203 | 42405270 | | Oiva Hannula & Sons, Inc. | 1 | 0.15 | Jungle Bog | Carver |
| 95-04 | 9P242405203 | 42405270 | | Oiva Hannula & Sons, Inc. | 1 | 0.15 | Jungle Bog Well | Carver |
| 95-04 | 9P242405203 | 42405270 | | Oiva Hannula & Sons, Inc. | 1 | 0.15 | Shaw Bog | Carver |
| | 9P242405203 | 42405270 | | Oiva Hannula & Sons, Inc. | 1 | 0.15 | New Shaw Bog | Carver |
| 95-04 | | 42405202 | | Oiva Harju | 0.14 | 0 | France Street Reservoir | Middleboro |
| 95-06 | | 42431001 | | Old Tuck Cranberry Corporation | 0.37 | 0 | Old Tuck Reservoir | Rochester |
| 95-02 | | 42431029 | | Onset Bogs-P & M Piscitelli | 0.21 | 0 | Onset Bog #1 | Wareham |
| 95-02 | | 42431029 | | Onset Bogs-P & M Piscitelli | 0.21 | 0 | Onset Bog #2 | Wareham |
| | 9P42431001 | 42431031 | 4310003 | Onset Fire District | 0.49 | 0.64 | Sand Pond/Station 1 | Onset |
| 95-01 | 9P42431001 | 42431031 | 4310003 | Onset Fire District | 0.49 | 0.64 | Well #3 | Onset |
| 95-01 | 9P42431001 | 42431031 | 4310003 | Onset Fire District | 0.49 | 0.64 | Well #4 | Onset |
| 95-02 | 9P42431001 | 42431031 | 4310003 | Onset Fire District | 0.49 | 0.64 | 4310003-03G | Wareham |
| 95-02 | 9P42431001 | 42431031 | 4310003 | Onset Fire District | 0.49 | 0.64 | 4310003-04G | Wareham |
| 95-04 | | 42431004 | | P & S Cranberry Service Inc. | 0.12 | 0 | P&S Bogs | W. Wareham |
| 95-04 | | 42431011 | | Patterson Brook Corp | 0.12 | 0 | S-Curve Bog | W. Wareham |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|---------|---|-------------------------|--------------------------------|--------------------------|----------------|
| 95-04 | | 42405203 | | Paul + Linda Rinta | 0.43 | 0 | Beach Street Reservoir | Middleboro |
| 95-04 | | 42405203 | | Paul + Linda Rinta | 0.43 | 0 | Holding Pond #1 | West Wareham |
| 95-04 | | 42405203 | | Paul + Linda Rinta | 0.43 | 0 | Weweantic River | Carver/Wareham |
| 95-06 | | 42405203 | | Paul + Linda Rinta | 0.43 | 0 | High Street Reservoir | Rochester |
| 95-04 | | 42431052 | | Perry Cranberry Company, Inc. | 0.13 | 0 | Perry Bog (River) | So. Middleboro |
| 95-04 | | 42431052 | | Perry Cranberry Company, Inc. | 0.13 | 0 | Perry Bog (Street) | So. Middleboro |
| 95-30 | | 42431052 | | Perry Cranberry Company, Inc. | 0.13 | 0 | Perry Reservoir | Wareham |
| 95-04 | | 42405205 | | Perry's Berries Incorporated | 0.18 | 0 | Center Street Reservoir | Carver |
| 95-04 | | 42405205 | | Perry's Berries Incorporated | 0.18 | 0 | Rochester Road Reservoir | Carver |
| 95-04 | | 42405258 | | Peter A. and Susan J. Webb | 0.1 | 0 | Wenham Pond | Carver |
| | 9P242400302 | | | Pine Hill Farm | | 0.06 | Reservoir A (Bogs 5 & 6) | Acushnet |
| | 9P242400302 | | | Pine Hill Farm | | 0.06 | Reservoir B (Bogs 1-4) | Acushnet |
| 95-04 | | 42431022 | | Piney Wood Cranberries | 0.54 | 0 | Big George Well | Plymouth |
| 95-04 | | 42431022 | | Piney Wood Cranberries | 0.54 | 0 | Piney Wood Reservoir #1 | Plymouth |
| 95-04 | | 42431022 | | Piney Wood Cranberries | 0.54 | 0 | Piney Wood Reservoir #2 | Plymouth |
| 95-04 | | 42431022 | | Piney Wood Cranberries | 0.54 | 0 | Piney Wood Reservoir #3 | Plymouth |
| 95-04 | | 42423913 | | Pitch Pine Trust | 0.04 | 0 | Pitch Pine Trust Bog | Plymouth |
| 95-04 | 9P42423901 | | 4239000 | Plymouth DPW-Water Division | | 6.36 | Darby Pond Well | Plymouth |
| 95-04 | 9P42423901 | | 4239000 | Plymouth DPW-Water Division | | 6.36 | Federal Furnace Well | Plymouth |
| 95-01 | 9P442423905 | | 4239045 | Plymouth Water Company | | 0.22 | Well #1 | Plymouth |
| 95-01 | 9P442423905 | | 4239045 | Plymouth Water Company | | 0.22 | Well #2 | Plymouth |
| 95-17 | | 42203601 | | Pocasset Golf Club (average withdrawal over <365 days) | 0.09 | 0 | Well #1 | Pocasset |
| 95-29 | | 42431055 | | Popes Pond Cranberry Co., Inc. | 0.05 | 0 | Popes Pond Cranberry | East Wareham |
| 95-06 | | 42431026 | | Porter Bog Company, Inc. | 0.29 | 0 | Leonards Pond | Rochester |
| 95-06 | | 42431026 | | Porter Bog Company, Inc. | 0.29 | 0 | Porter Bog #1 | Rochester |
| 95-04 | | 42405221 | | Pratt Cranberry Bogs | 0.06 | 0 | Wenham Pond | Carver |
| 95-01 | | 42423901 | | R & B Farms, Inc. | 0.05 | 0 | R & B Farms Reservoir | Plymouth |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|-------------------------------------|-------------------------|--------------------------------|-----------------------|---------------|
| 95-06 | | 42425010 | | R.H. Bogs, Inc. | 0.27 | 0 | Leonards' Pond | Rochester |
| 95-06 | | 42425010 | | R.H. Bogs, Inc. | 0.27 | 0 | Marys' Pond | Rochester |
| 95-04 | | 42418204 | | Ragnar & Karen Bjornson | 0.24 | 0 | Purchase Street Bog | Middleboro |
| 95-06 | | 42418204 | | Ragnar & Karen Bjornson | 0.24 | 0 | County Street Bog | Rochester |
| 95-04 | | 42405250 | | Ralph and Judith Kivi | 0.07 | 0 | Rochester Road Bogs | Carver |
| 95-04 | | 42405234 | | Ralph Peltola | 0.27 | 0 | Cranberry Bogs | Carver |
| | | 42418217 | | Reginald C & Lyn Petty | 0.12 | | Francis Street Bog | Middleboro |
| | | 42418217 | | Reginald C & Lyn Petty | 0.12 | | Pine Street | Middleboro |
| 95-42 | | 42420101 | | Revere Copper Products, Inc. | 0.08 | 0 | Rodman Pond | New Bedford |
| 95-06 | | 42431042 | | Richard A. Fielding | 0.05 | 0 | Richard Fielding | Rochester |
| 95-31 | | 42410202 | | Richard H. Kendrick | 0.08 | 0 | Korpy Bog Reservoir | East Freetown |
| 95-06 | | 42410208 | | Richard H. Kendrick, Jr. | 0.1 | 0 | Kendrick Bog #2 | Rochester |
| 95-31 | | 42410208 | | Richard H. Kendrick, Jr. | 0.1 | 0 | Kendrick Bog #1 | East Freetown |
| | | 42410211 | | Richard T. Berndt | 0.21 | 0 | | |
| 95-31 | | 42410210 | | Ridge Hill Cranberry Company | 0.21 | 0 | Ridge Hill Bogs | East Freetown |
| | 9P242423902 | | | Ring Road Realty Trust Cranberry | 0 | 0.12 | Bog Pond | Carver |
| 95-06 | | 42425014 | | Robert & Donald Merry Cranberry Bog | 0.18 | 0 | Merry Blacks Bogs | Rochester |
| 95-06 | | 42425014 | | Robert & Donald Merry Cranberry Bog | 0.18 | 0 | Merry Howes Bog | Rochester |
| 95-04 | | 42431005 | | Robert E. Johnson | 0.14 | 0 | R. Johnson Reservoir | Middleboro |
| 95-07 | | 42431045 | | Robert F. Pajunen | 0.01 | 0 | Pajunen Bog #2 | W. Wareham |
| 95-30 | | 42423912 | | Robert Meharg | 0.43 | 0 | Meharg Bog #1 | Wareham |
| 95-31 | | V42400302 | | Roger Braley Orchards | 0.03 | 0 | Acushnet River | Acushnet |
| 95-31 | | V42400302 | | Roger Braley Orchards | 0.03 | 0 | New Bedford Reservoir | Acushnet |
| 95-02 | | 42431060 | | Rounsville, Hammond and Rounsville | 0.28 | 0 | Agawam River | East Wareham |
| 95-02 | | 42431060 | | Rounsville, Hammond and Rounsville | 0.28 | 0 | Dick's Pond | East Wareham |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|-------|------------------------------------|-------------------------|--------------------------------|--------------------------|--------------|
| 95-02 | | 42431060 | | Rounsville, Hammond and Rounsville | 0.28 | 0 | Sand Pond | East Wareham |
| 95-02 | | 42431060 | | Rounsville, Hammond and Rounsville | 0.28 | 0 | Sand Pond | East Wareham |
| 95-02 | | 42431060 | | Rounsville, Hammond and Rounsville | 0.28 | 0 | Sand Pond | East Wareham |
| 95-02 | | 42431060 | | Rounsville, Hammond and Rounsville | 0.28 | 0 | Spectacle Pond | East Wareham |
| 95-04 | | V42418209 | | Russell Bradbury | 0.04 | 0 | Russell Bradbury | Middleboro |
| 95-06 | | 42425002 | | Ryder Bog & Sherman Bog | 0.33 | 0 | Sherman Bog | Rochester |
| 95-36 | | 42425002 | | Ryder Bog & Sherman Bog | 0.33 | 0 | Ryder Bog | Rochester |
| 95-04 | | 42405237 | | S.K. Wainio Bogs, Inc. | 0.14 | 0 | Wainio Bog | Carver |
| 95-04 | | 42405207 | | Salmi Bogs | 0.05 | 0 | Salmi Bogs | South Carver |
| 95-04 | | 42405207 | | Salmi Bogs | 0.05 | 0 | Tremont Street Well | South Carver |
| 95-05 | 9P242425003 | | | SEMASS Partnership | | 0.33 | Industrial Well A | West Wareham |
| 95-05 | 9P242425003 | | | SEMASS Partnership | | 0.33 | Industrial Well B | West Wareham |
| 95-05 | 9P242425003 | | | SEMASS Partnership | | 0.33 | Industrial Well C | West Wareham |
| 95-05 | 9P242425003 | | | SEMASS Partnership | | 0.33 | Potable Well B | Rochester |
| 95-05 | 9P242425003 | | | SEMASS Partnership | | 0.33 | Potable Well A | Rochester |
| 95-06 | | 42425016 | | Shakey Acres Cranberries | 0.04 | 0 | Shakey Acres Bogs | Rochester |
| 95-07 | | 42431063 | | Sheila R Perry | 0.03 | | Pond | West Wareham |
| 95-04 | | V42405264 | | Shoestring Bogs | 0.04 | 0 | Water Hole | Carver |
| 95-04 | | 42419601 | | Shurtleff Cranberry Bogs, Inc. | 0.17 | 0 | Benson Pond Bog #1 | Middleboro |
| 95-04 | | 42419601 | | Shurtleff Cranberry Bogs, Inc. | 0.17 | 0 | Benson Pond Bog #2 | Middleboro |
| 95-04 | | 42419601 | | Shurtleff Cranberry Bogs, Inc. | 0.17 | 0 | Benson Pond Bog #3 | Middleboro |
| 95-04 | | 42419601 | | Shurtleff Cranberry Bogs, Inc. | 0.17 | 0 | Benson Pond Bog #4 | Middleboro |
| 95-04 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Wareham Street Reservoir | South Carver |
| 95-06 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Red Gate Reservoir | Rochester |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|------------|--------------|---------|----------------------------------|-------------------------|--------------------------------|------------------------|---------------|
| 95-06 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Red Gate Well #1 | Rochester |
| 95-30 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Tihonet Road Reservoir | South Carver |
| 95-30 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Tihonet Road Well #1 | South Carver |
| 95-30 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Wareham Street Well #1 | South Carver |
| 95-30 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Off Rt. 28 | West Wareham |
| 95-30 | | 42405224 | | Slocum-Gibbs Cranberry Co., Inc. | 1.73 | 0 | Wareham Street Well #2 | South Carver |
| 95-04 | | 42405222 | | South Meadow Brook Trust | 0.04 | 0 | South Meadow Brook | Carver |
| 95-04 | 9P42405202 | | 4052001 | South Meadow Village | | 0.19 | Wellfield #2 | Carver |
| 95-04 | | 42423909 | | Southers Marsh Cranberry Bogs | 0.25 | 0 | Southers Marsh Bogs | Plymouth |
| 95-04 | | 42423909 | | Southers Marsh Cranberry Bogs | 0.25 | 0 | Southers Marsh Well #1 | Plymouth |
| 95-04 | | 42423909 | | Southers Marsh Cranberry Bogs | 0.25 | 0 | Southers Marsh Well #2 | Plymouth |
| 95-04 | | 42423909 | | Southers Marsh Cranberry Bogs | 0.25 | 0 | Southers Marsh Well #3 | Plymouth |
| 95-04 | | 42423909 | | Southers Marsh Cranberry Bogs | 0.25 | 0 | Southers Marsh Well #4 | Plymouth |
| 95-06 | | 42418208 | | Spring Brook Cranberries | 0.05 | 0 | County Road Bog | Rochester |
| 95-31 | | 42410201 | | Squinns Brook Corporation | 0.11 | 0 | Squinns Brook Bog | East Freetown |
| 95-04 | | 42405223 | | Stanley E. & Anne-Marie Lowell | 0.29 | 0 | Lowell Bogs | Carver |
| 95-04 | | 42405223 | | Stanley E. & Anne-Marie Lowell | 0.29 | 0 | Lowell Well | Carver |
| 95-04 | | 42405229 | | Stephen Peltola | 0.09 | 0 | Peltola Bogs | Carver |
| 95-04 | | 42431053 | | Suominen Inc. | 0.09 | 0 | Northern Bens Pond | Carver |
| 95-04 | | 42431053 | | Suominen Inc. | 0.09 | 0 | Southern Bens Pond | Carver |
| 95-04 | | 42431053 | | Suominen Inc. | 0.09 | 0 | Suominen Reservoir #1 | Carver |
| 95-04 | | 42431053 | | Suominen Inc. | 0.09 | 0 | Suominen Well | Carver |
| 95-04 | | 42423906 | | Susan & Nancy Meharg | 0.09 | 0 | Meharg Bogs | Carver |
| 95-06 | | 42425015 | | Suzanne M. Bauer-Maintain Bog | 0.09 | 0 | Mountain Bog Sump | Rochester |
| 95-14 | | 42403601 | | Tassinari Cranberries | 0.08 | 0 | Tassinari Reservoir | Buzzards Bay |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|--------|--------------|-------|------------------------------------|-------------------------|--------------------------------|-----------------------------|--------------------|
| 95-14 | | 42403601 | | Tassinari Cranberries | 0.08 | 0 | Tassinari Well | Buzzards Bay |
| 95-06 | | 42425011 | | Thomas Gayoski, Jr. | 0.18 | 0 | Thomas Gayoski | Rochester |
| 95-06 | | 42431054 | | Thomas I. Morse | 0.07 | 0 | Morse Bog #1 | Rochester |
| 95-06 | | 42431054 | | Thomas I. Morse | 0.07 | 0 | Morse Bog #2 | Rochester |
| 95-06 | | 42431054 | | Thomas I. Morse | 0.07 | 0 | Morse Bog #3 | Rochester |
| 95-06 | | 42431054 | | Thomas I. Morse | 0.07 | 0 | Morse Bog #4 | Rochester |
| 95-36 | | V42417302 | | Tinkham Cranberry Bog | 0.03 | 0 | Tinkham Bog | Mattapoissett |
| 95-04 | | 42431013 | | Tremont Cranberry Co., LLC | 0.04 | 0 | Weweantic River | Wareham |
| 95-18 | | 42209608 | | Tupper, Ralph S. | 0.04 | 0 | Cranberry Bogs (C1, C2, C3) | Cataumut |
| 95-21 | | 42209608 | | Tupper, Ralph S. | 0.04 | 0 | Cranberry Bogs (C4, C5, C6) | West Falmouth |
| --- | | 42209608 | | Tupper, Ralph S. | 0.04 | 0 | Cranberry Bogs (7 others) | Cape Cod Watershed |
| 95-04 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | Pierceville Sumps | Wareham |
| 95-04 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | Weweantic River | Wareham |
| 95-05 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | Mendall Irrigation Sump | Marion |
| 95-29 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | North of 25 Well | Wareham |
| 95-29 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | Sandusky Irrigation Sump | Wareham |
| 95-30 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | Sandusky Bog | Wareham |
| 95-30 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | Harlow Brook Sump | Wareham |
| 95-30 | | 42431025 | | Tweedy & Barnes Company | 1.17 | 0 | Harlow Vineyard Sump | Wareham |
| 95-02 | | 42431020 | | UMass-Cranberry Experiment Station | 0.1 | 0 | Spectacle Pond Bogs | East Wareham |
| 95-04 | | 42431020 | | UMass-Cranberry Experiment Station | 0.1 | 0 | Rocky Pond | Plymouth |
| 95-02 | | 42431023 | | W.D. Ames, Inc. | 0.09 | 0 | Beaver Dam Pond | Wareham |
| 95-29 | | 42431023 | | W.D. Ames, Inc. | 0.09 | 0 | Gracia Bog | Wareham |
| 95-04 | | 42405276 | | W.D. Bog, Inc. | 0.06 | 0 | W.D. Bog | Carver |
| 95-04 | | 42405245 | | Ward Cranberry Bogs | 0.08 | 0 | South Meadow Brook | Carver |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|------------|--------------|---------|------------------------------|-------------------------|--------------------------------|-------------------------|------------------|
| 95-04 | | 42405245 | | Ward Cranberry Bogs | 0.08 | 0 | Wenham Pond | Carver |
| 95-04 | | 42405274 | | Ward Richard Hannula | 0.1 | 0 | Paduch Bog | Carver |
| 95-28 | 9P42431002 | 42431012 | 4310000 | Wareham Fire District | 1.31 | 0.64 | 4310000-05G | Wareham |
| 95-28 | 9P42431002 | 42431012 | 4310000 | Wareham Fire District | 1.31 | 0.64 | Maple Spring Well #1 | Wareham |
| 95-29 | 9P42431002 | 42431012 | 4310000 | Wareham Fire District | 1.31 | 0.64 | Maple Spring Well #2 | Wareham |
| 95-28 | 9P42431002 | 42431012 | 4310000 | Wareham Fire District | 1.31 | 0.64 | Maple Spring Well #3 | Wareham |
| 95-28 | 9P42431002 | 42431012 | 4310000 | Wareham Fire District | 1.31 | 0.64 | Maple Spring Well #4 | Wareham |
| 95-29 | 9P42431002 | 42431012 | 4310000 | Wareham Fire District | 1.31 | 0.64 | Seawood Springs #7 | Wareham |
| 95-28 | 9P42431002 | 42431012 | 4310000 | Wareham Fire District | 1.31 | 0.64 | Seawood Springs Well #6 | Wareham |
| 95-04 | | 42405201 | | Warren & Nancy Martin | 0.09 | 0 | France Street Bog | South Middleboro |
| 95-04 | | 42405272 | | Wayne A. Hannula | 0.16 | 0 | Melville Bog | Middleboro |
| 95-04 | | 42405272 | | Wayne A. Hannula | 0.16 | 0 | Roderick Bog | Middleboro |
| 95-04 | | 42405285 | | Weston Brothers Cranberries | 0.68 | | Crane Brook | Carver |
| 95-04 | | 42405285 | | Weston Brothers Cranberries | 0.68 | | Indian Rd. Bog | Carver |
| 95-09 | | 42416906 | | White Eagle Realty Trust | 0.22 | 0 | Sippican Reservoir | Marion |
| 95-04 | | 42405254 | | White Springs Bogs | 0.2 | 0 | 0 & 1 Irrigation Sump | So. Carver |
| 95-04 | | 42405254 | | White Springs Bogs | 0.2 | 0 | 0 & 1 Well | So. Carver |
| 95-30 | | 42405254 | | White Springs Bogs | 0.2 | 0 | 2 & 3 Irrigation Sump | So. Carver |
| 95-30 | | 42405254 | | White Springs Bogs | 0.2 | 0 | 4 & 5 Irrigation Sump | So. Carver |
| 95-30 | | 42405254 | | White Springs Bogs | 0.2 | 0 | 6 Irrigation Sump | So. Carver |
| 95-30 | | 42405254 | | White Springs Bogs | 0.2 | 0 | Barretts Pond | So. Carver |
| 95-04 | | 42405236 | | Wilho E. Harju | 0.19 | 0 | Weweantic River Bog | Middleboro |
| 95-04 | | 42423910 | | William B. Stearns, III & IV | 0.09 | 0 | Indian Brook Well #1 | Plymouth |
| 95-04 | | 42423910 | | William B. Stearns, III & IV | 0.09 | 0 | Indian Brook Well #2 | Carver |
| 95-04 | | 42423910 | | William B. Stearns, III & IV | 0.09 | 0 | Indian Brook Well #3 | Carver |
| 95-29 | | 42403607 | | William F. Atwood | 0.19 | 0 | Bang's Bog | Wareham |
| 95-04 | | 42405275 | | William F. Pierce, Sr. | 0.05 | 0 | Pierce Bog | Carver |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|-------------|--------------|---------|---|-------------------------|--------------------------------|---|-----------------------|
| 95-04 | | 42405235 | | William L. Remes | 0.06 | 0 | Tilson Brook | South Carver |
| 95-04 | | 42405262 | | Williams & Alger, Inc. | 0.27 | 0 | Big Bog Reservoir | So. Carver |
| 95-04 | 9P342431005 | 42423914 | | Willows Cranberries | 0.11 | 0.09 | Darby Pond | Plymouth |
| 95-04 | 9P342431005 | 42423914 | | Willows Cranberries | 0.11 | 0.09 | Pump at Reservoir | Wareham |
| 95-04 | 9P342431005 | 42423914 | | Willows Cranberries | 0.11 | 0.09 | Pump at Tailwater Pond | Plymouth |
| 95-36 | | 42425013 | | Wolf Island Bog | 0.04 | 0 | Wolf Island Bogs | Rochester |
| 95-25 | | 42209606 | | Woods Hole Golf Club (average withdrawal over <365 days) | 0.08 | 0 | Wells #1 & #2 | Woods Hole |
| 95-14 | | 42226109 | | Mirant Canal, LLC | 0.45 | 0 | Freezer Rd Well #1 Freezer Rd Well #2 | Sandwich |
| 95-17 | | 42203601 | | Pocasset Golf Club* | 0.09 | 0 | Well #1 | Pocasset |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Sta. #1 (has 4 wells) | Monument Beach |
| 95-18 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #2 | Cataumet |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Sta. #3 State forest | Monument Beach |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #4 | Monument Beach |
| 95-18 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #5 | Cataumet |
| 95-16 | 9P42203601 | 42203602 | 4036000 | Bourne Water District | 0.73 | 0.67 | Pump Station #6 | Pocasset |
| 95-15? | | 42203604 | | John M. Alden | 0.12 | 0 | C-1 Surface Supply | Monument Beach |
| 95-25 | | 42209606 | | Woods Hole Golf Club* | 0.08 | 0 | Wells #1 & #2 | Woods Hole |
| 95-23 | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Long Pond Reservoir | Falmouth |
| 95-24 | | | | | | | | |
| 95-23? | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Mares Pond Well | Falmouth |
| 95-22 | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Crooked Pond Well | Falmouth |
| --- | 9P42209601 | 42209607 | 4096000 | Falmouth Water Department | 2.95 | 1.36 | Fresh Pond Well & Coonamessett Pond Well | Cape Cod Watershed |
| 95-18 | | 42209608 | | Ralph S. Tupper | 0.04 | 0 | Cranberry Bogs (C1, C2, C3) | Catamut |
| 95-21 | | 42209608 | | Ralph S. Tupper | 0.04 | 0 | Cranberry Bogs (C4, C5, C6) | West Falmouth |

| Segment | Permit | Registration | PWSID | System Name | Registered Volume (MGD) | 20 Year Permitted Volume (MGD) | Source Name | Location |
|---------|--------|--------------|-------|-----------------------|-------------------------------|--|---------------------------------|-----------------------|
| --- | | 42209608 | | Ralph S. Tupper | 0.04 | 0 | Cranberry Bogs (7 others) | Cape Cod Watershed |
| 95-18 | | 42209609 | | Handy Cranberry Trust | 2.08 | 0 | Cranberry Bog Wells (#1, #2) | Cataumet |
| --- | | 42209609 | | Handy Cranberry Trust | 2.08 | 0 | Cranberry Bog s (11G & 2S) | Cape Cod |

